ELECTRICAL REVIEW

FRIDAY 4 AUGUST 1939

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ELECTRICAL REVIEW

14 August 1959 Vol. 165 No. 1 Established 1872

Domestic Appliance Business

RELIABLE statistics of the production of domestic electrical appliances are harder to come by in this country than, for instance, in the United States, for British manufacturers have been notoriously reticent or secretive about it lest they should tell their competitors too much. Board of Trade figures of " deliveries " of domestic electrical appliances during 1958 gave a total value of £103·5 million, but this does not include refrigerator deliveries which are believed to have amounted in value to about £20 million. If list prices, plus purchase tax, are taken the result is a total of well over £200 million. These figures indicate big business but even so it is by no means as big as it could be, judging from surveys made by the electricity supply industry and private research bodies.

It may be assumed that the " typical cross section " method used in these surveys gives a reasonably fair indication of the general position and, accepting this, it is seen that the domestic electrical appliance market is far from " saturation " in most directions. Cookers must be considered first for they are perhaps the most essential item of the household. Electric cookers have been making headway against their gas rivals but it seems that still only a quarter of households have one. Much the same can be said of water heaters. Among other of the larger appliances washing machines appear to have made the greatest progress and they are now believed to have nearly caught up with cookers. Refrigerators have been moving up at a good rate but the scope for expansion is still very great. In addition to sales of appliances to " new " customers there is an enormous replacement business; the modern tendency is to write off equipment in a shorter period and this extends into the domestic sphere.

With all this in mind it was inevitable that the makers of domestic electrical appliances should seek to get together more closely to discuss and promote their

THE "ELECTRICAL REVIEW"

***BECAUSE** of the recent stoppage in the printing industry, publication of the " Electrical Review " was suspended after the issue of 19th June. The present number, which commences Volume 165, is therefore the first for eight weeks. We regret the inconvenience caused by this break in continuity but it is our intention that all developments of electrical interest during the period of non-publication shall be recorded. This issue contains an eight-page section briefly reviewing the more important events of the period, new appointments, etc. Commencing next week, additional space will be devoted to new electrical equipment and the 21st August issue will also include our illustrated domestic electric fire survey, which would normally have been published at the beginning of July.*

Current subscriptions will be adjusted by postponing the renewal date for the period of the stoppage.

common interests. This is the *raison d'être* of the new Division set up by the Council of the British Electrical and Allied Manufacturers' Association for its "domestic" members. From the list we have published it will be seen that there is a strong representation of the leading appliance makers on the Board and Sections of the Division. Initially there are five sections but an electric pad and blanket section is being set up and arrangements for co-operation with domestic refrigerator makers are being actively considered.

One important aim of the Division is "the collection and dissemination of statistics of electrical appliances in place of those previously dealt with through the Board of Trade." This gives hope that more complete and prompter figures will soon become available. Secrecy so far as individual members are concerned will be preserved by the handling of the returns by an independent firm of accountants. The Division's interests extend overseas by virtue of its representation on the Council Européen de la Construction Electro-Domestique. By this means a watch will be kept on all marketing matters affecting the British manufacturers. We think that much good and greater progress should result from the work of the new Domestic Division, particularly if other than B.E.A.M.A. members can be persuaded to co-operate in the provision of statistics.

I.E.E. FINANCES

At a special general meeting of the corporate members of the Institution of Electrical Engineers in June proposals by the Council to increase subscriptions were rejected. It appeared that, however good the Council's case might be, members thought that the Institution's financial position should be improved by economies rather than by higher subscriptions. Now the Council, having considered the position, has called another meeting (for 18th August) at which a revised scale of increases will be presented.

In memoranda accompanying the notice of the meeting the Council repeats at greater length its arguments for the increases. This case is largely based on the fall in the value of money and the impossibility of achieving economies big enough to put the Institution's finances on a better footing without a drastic curtailment of its activities. It will be revealed at the meeting whether the mere reduction of the proposed increases will meet the objections of the opposition.

PRICE AGREEMENT APPROVED

The success of the Water-Tube Boilermakers' Association in getting their agreement upheld by the Restrictive Practices Court will have given some encouragement to those whose cases have still to be heard. The previously unbroken record of adverse decisions had made it begin to seem possible that the Court would find all existing agreements contrary to the public interest. A closer reading of the judgment is, however, likely to temper any initial optimism. The boiler-making industry has many unusual features and it is, unlike the country generally, experiencing a period of depression that may last for five years. Though the Court recognised that this agreement did not lead to inflated prices, the only one of the Association's arguments that it fully accepted was that in which it was maintained that the removal of the restriction would cause a substantial drop in export earnings.

Of greater importance to those who may be looking for solace in the result of this case was the Court's summary dismissal of the traditional arguments put forward in defence of price agreements in heavy engineering. The Court did not agree that without the scheme quality would deteriorate, collective research cease and manufacturers lack the resources to keep in business during the contemplated recession. The favourable decision by the Court in this case does not indicate that they are interpreting the Act less strictly.

INDUSTRIAL MAINTENANCE

As was pointed out by speakers in the discussion on Mr. R. A. Joseph's E.C.A. Conference paper dealing with factory maintenance by electrical contractors, there was an apparent conflict between the author's contention that the small contractor was the backbone of such a system and the extent and complexity of the equipment required to do the job. It is all a matter of degree: small contractors can undertake to look after small installations and large firms can look after the bigger factories. There is a possibility of employing specialist repair firms for some of the work, which would bring the larger installations into the scope of the small contractor. Again, the small men might combine to set up a maintenance service, although previous suggestions for co-operation, e.g., showrooms, have not got very far. In any event a factory installation can generally be better looked after by a contractor than by the factory's own "all-round" staff who lack the special knowledge needed.

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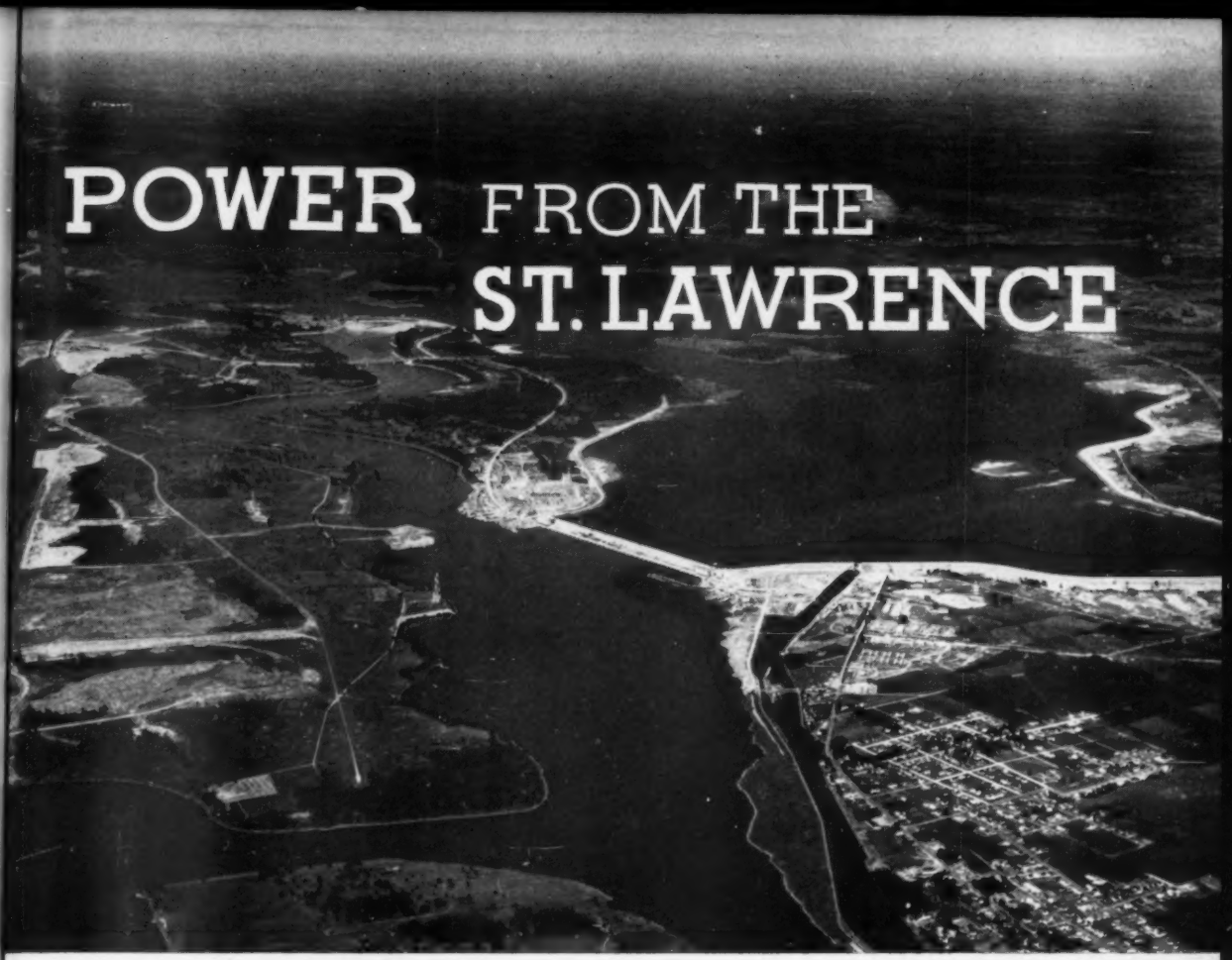
POWER FROM THE ST. LAWRENCE



ELECTRICAL REVIEW 14 AUGUST 1959

CANADIAN-AMERICAN 1,880 MW SCHEME

By R. C. GOLDING, M.Sc.(Eng.), A.M.I.E.E., A.M.I.Mech.E.*

The St. Lawrence Seaway, together with its associated power project, forms one of the most ambitious projects ever undertaken in the field of Canadian engineering. The Seaway was officially inaugurated by Her Majesty the Queen and the President of the United States on 26th June

FROM a technical standpoint, the St. Lawrence power and navigation projects are integrated. Combined with these are certain aspects of flood control, with the engineering features of each dependent upon the other aims of the project. However, they have been financed, built, and are being operated as distinct entities. The power project was the more costly of the two, representing the expenditure of some $600 million.

The importance of the Seaway lies, of course, in the facts that it opens up the whole of the interior of the North American continent to world maritime traffic and adds more than 3,000 miles to Canada's coastline. It is the former fact which led to 50 years of organised opposition to the project from rail and road interests in the United States. Canada's interest has been chiefly in the field of cheap electrical power. With this aspect in mind, she has exerted what pressure she could on the United States to give effect to the combined plan. The Seaway might have been constructed without the power scheme, but not vice versa. This arises from the fact that some of the power dams which had to be constructed end on one side in the United States and at the other end in Canada. Water levels are also considerably affected in both countries where the river forms the boundary.

The importance of the power aspect lies not only in the kilowatt capacity which lay unharnessed; the kilowatt-hour capabilities are almost unrivalled in the world. With the backing of the five Great Lakes, the reservoir storage capacity of the St. Lawrence is immense. This results in a number of interesting comparisons of the hydraulic flow. In the first instance let us assume that Lake Superior is cut off from all inflowing water. Let this

* Editor and Manager, *Modern Power and Engineering*, Toronto.

lake now become free from evaporation and, by gradually lifting the bed of the lake, let us keep the surface level constant as the lake empties. It has been calculated that it would take 75 years to empty Lake Superior, through the St. Lawrence. This immense capacity, situated as it is in the northern areas of Canada, with its high snowfall, results in a high minimum/maximum flow rate. For the St. Lawrence this is 1/2, compared with 1/12 for another great Canadian river, the Ottawa, and 1/33 for the Columbia River. The world's largest hydro-electric power development, Grand Coulee, is on the Columbia River. The effect of this is that a high output can be maintained in dry seasons as well as in wet. The resulting effect on summer electricity generation in Ontario is considerable, both from a cost and a quantity point of view.

Navigation Obstacles

From the early days of discovery, navigation on the St. Lawrence has been impeded by a series of rapids which stretch from Montreal, in the north-east, to some 115 milés to the south-west. The rapids were given such names as Lachine, Soulanges, and the International Rapids, the last being so named because the river forms the boundary between the United States and Canada along this stretch. Commencing from the end nearest to the open sea, these rapids were gradually by-passed by canals which allowed ships of reasonable draught to proceed further and further upstream, until the Great Lakes system was finally achieved. These canals were then widened and deepened over the years until, in 1904, locks were made available to provide a free draught of 14ft through the lakes.

A factor which gave some impetus to the demand for better transportation facilities was the difficulty of transport around Montreal during the war of 1812 between Canada and the United States. As early as 1815 the Imperial Government had in mind a canal from Lachine to the neighbourhood of Montreal. It is an interesting reflection on international affairs that that which was initiated by a war between the two nations, is now being completed by them on a co-operative basis.

The Lachine rapids are still below the site of the power house. They are thus still an obstacle to shipping and must still be by-passed by a canal. The construction of the power house dam has, however, formed a headpond some 35 miles in length. This has submerged all the remaining rapids, leaving navigation only the obstacles of the locks around the power house itself. It is true that there is another lock 28 miles upstream. This is made necessary by reason of the fact that the Iroquois Dam had to be built at this point to control the outflow of water from Lake Ontario, the lowest of the Great Lakes, into the St. Lawrence channel. However, the story of this dam is one of the Seaway proper and is of little consequence to the power project.

Power Project

Apart from the Iroquois Dam, the principal structures required for the power project were the international power house, the Long Sault Dam, built to act as a spillway, and the dykes. Because of the varying height of the lands which form the watershed of this section of the St. Lawrence River, it was found that creation of the headpond would flood a very large area of fertile land and some industrial property. In some instances this was allowed to proceed, notably in the instances of three or four villages and small townships which had to be picked up bodily and moved uphill, out of reach of the new water line. However, in some places, particularly those close to the power house where the headpond is naturally deepest, some 18 miles of concrete dykes have been built to contain the headwaters.

The project itself revolved around two great problems, one of which was the magnitude of the works, designed for a capacity of 1,880 MW, equally divided between Canada and the United States. The other major obstacle was the type and nature of the land to be flooded, to which reference has already been made. The fact that it was possible to limit the length of the headpond to some 35 miles in length was due to the fairly rapid rate of fall of the St. Lawrence in its nascent state. This, of course, also contributed to the frequent patches of rapids previously mentioned. In Canada, however, where such man-made headponds frequently stretch for hundreds of miles, this set of circumstances in the St. Lawrence valley enabled the extent of the power works to be kept within reasonable limits.

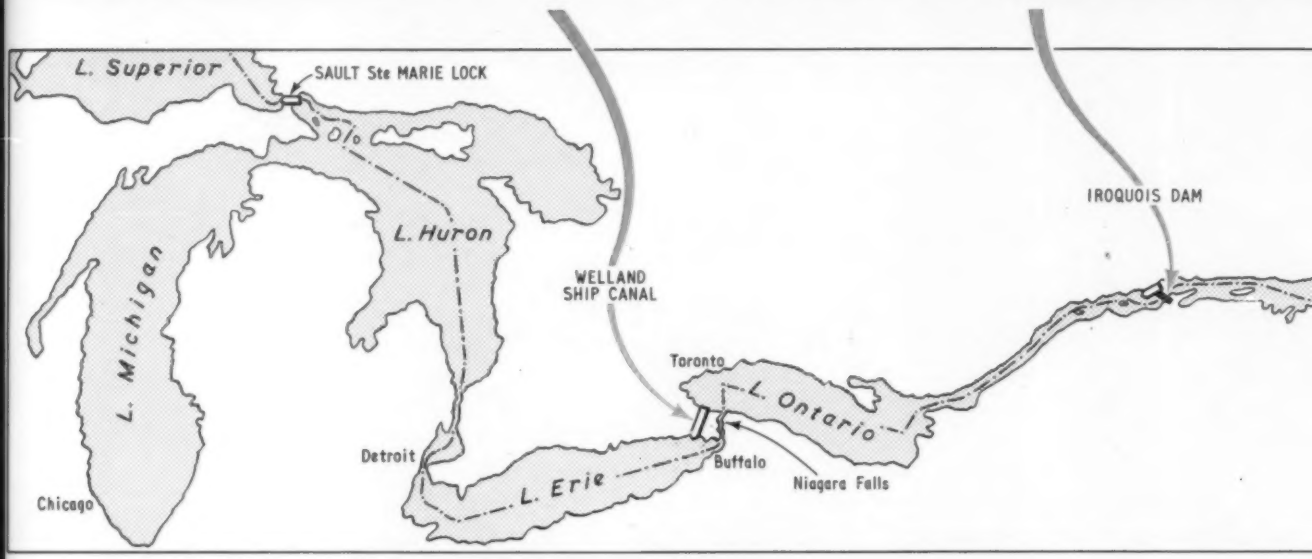
There are actually two power houses, although only the flags of the two nations make this obvious to the observer. They have been built in one unbroken line from the Canadian shore to Barnhart Island. This is a major island belonging to the United States in the St. Lawrence basin. The United States has built bridges across to this island from the mainland to provide access to the American works. The building of the power house bids fair, in fact, to become a major factor in the opening up and future development of the island. That section of the structure belonging to the United States has been named the Robert Moses Power Dam, after the chairman of the Power Authority of the State of New York. On the Canadian side the structure has been called the Robert H. Saunders-St. Lawrence generating station, after the late chairman of the Hydro-Electric Power Commission of Ontario. It was Mr. Saunders who had the credit for finally overcoming the opposition of the United States and bringing the project to fruition.

The whole structure houses 32 generators. The power house itself acts as a gravity dam, and has a maximum height of approximately 162ft above the foundation, with a total length of 3,300ft. While operating quarters will be housed in a conventional enclosure, the generators themselves will not. They are of a modified outdoor type, merely protected by removable covers. The conventional superstructure is omitted to provide easy access by means of a two-legged gantry crane which runs the whole length of the dam and can remove any generator or part, carrying it to the mainland for shipment if necessary.

Spillway Dam

The Long Sault Dam, a curved axis concrete gravity spillway structure, is 2,250ft long, and at its maximum height is 145ft above the foundation. It is situated some three miles above the power house. In conjunction with the power house, it functions to control the head of water required to operate the generators and to pass excess flow. The spillway is erected on the opposite side of Barnhart Island to the power house. It is thus well within American territory, and was in fact constructed by the Americans in two parts. Each half of the stream was coffer-dammed in turn, thus enabling construction to proceed in the dry. The spillway has a discharge capacity far in excess of the maximum flow of the river. Overflow takes place through thirty 50ft-wide vertical lift gates. Because of low winter temperatures, special precautions were taken against ice. The problem of keeping the gates and guides free during winter was met by the installation of appropriate heating arrangements.

Increasing the depth of water at the power house site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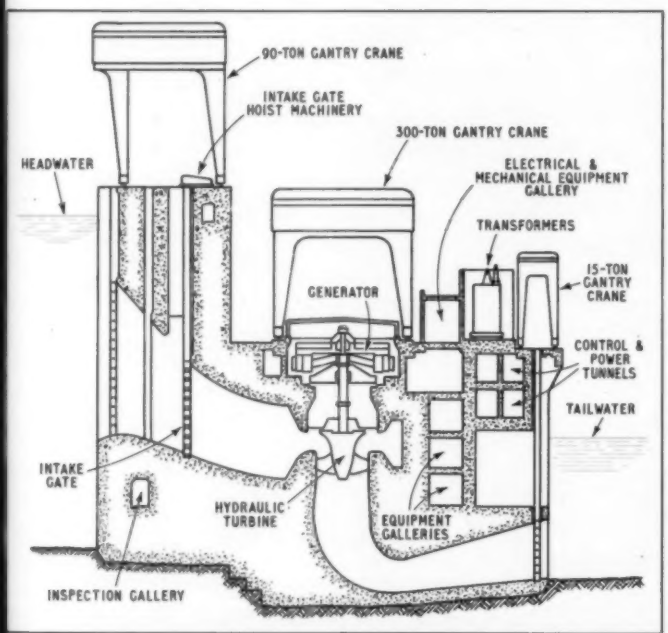
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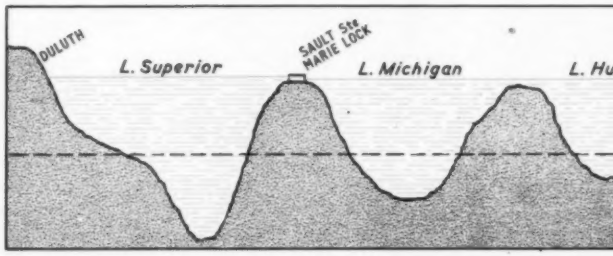
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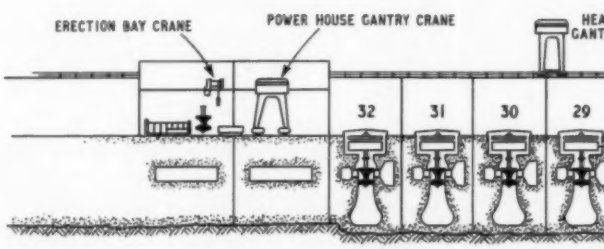
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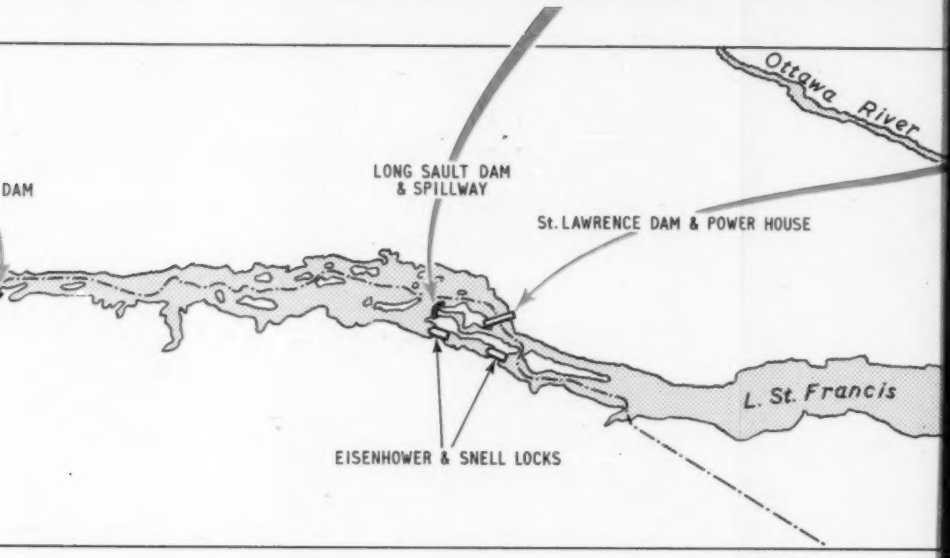
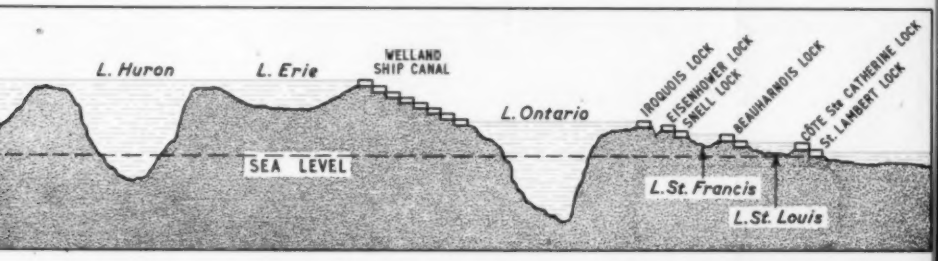
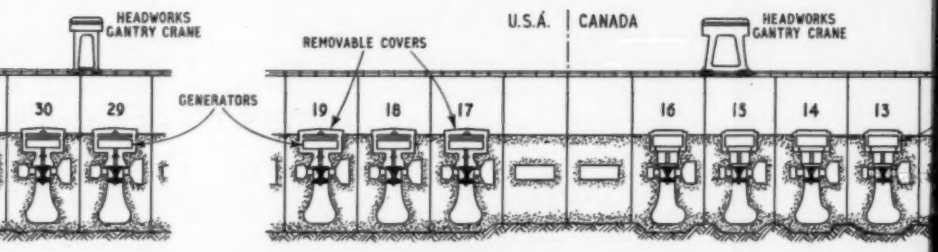
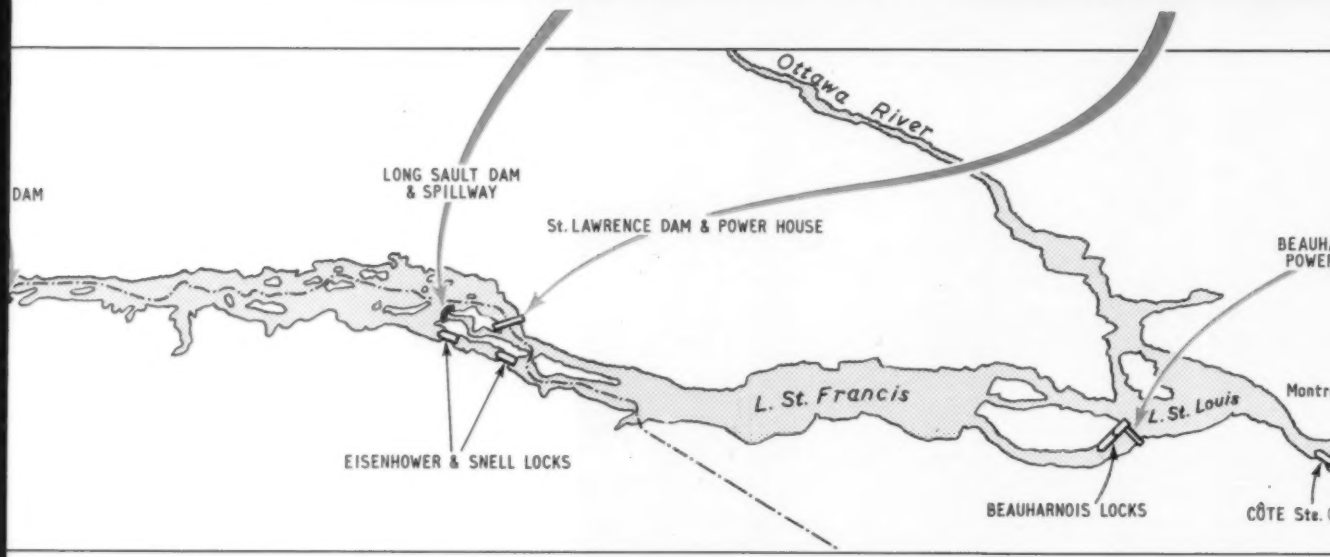
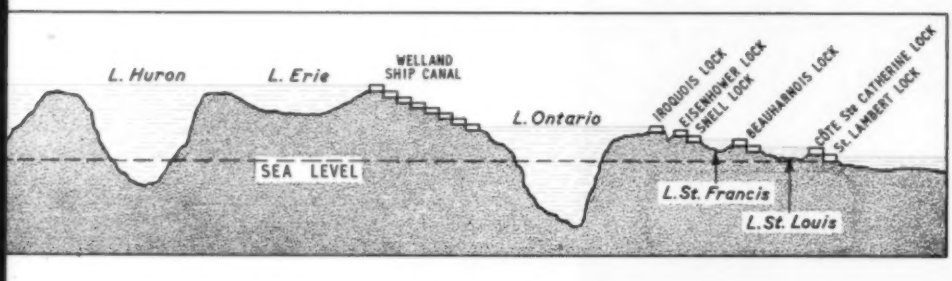




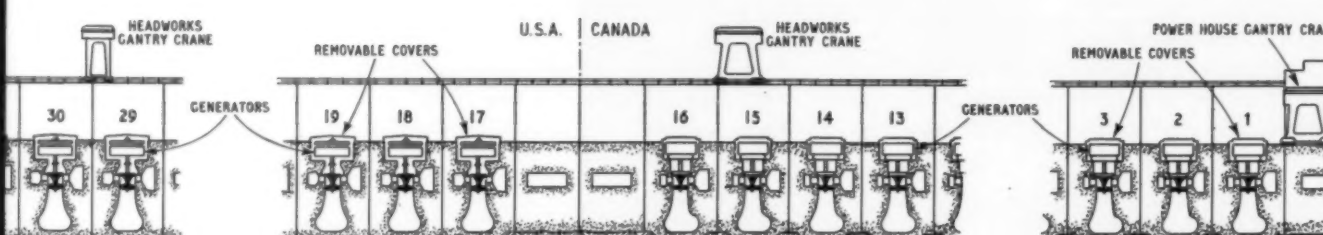


This schematic elevation shows the arrangement of the turbines and generators in the United States and Canadian section
the main power house. On the left is a vertical section of one of the American sets and on the right one of the Canadian s

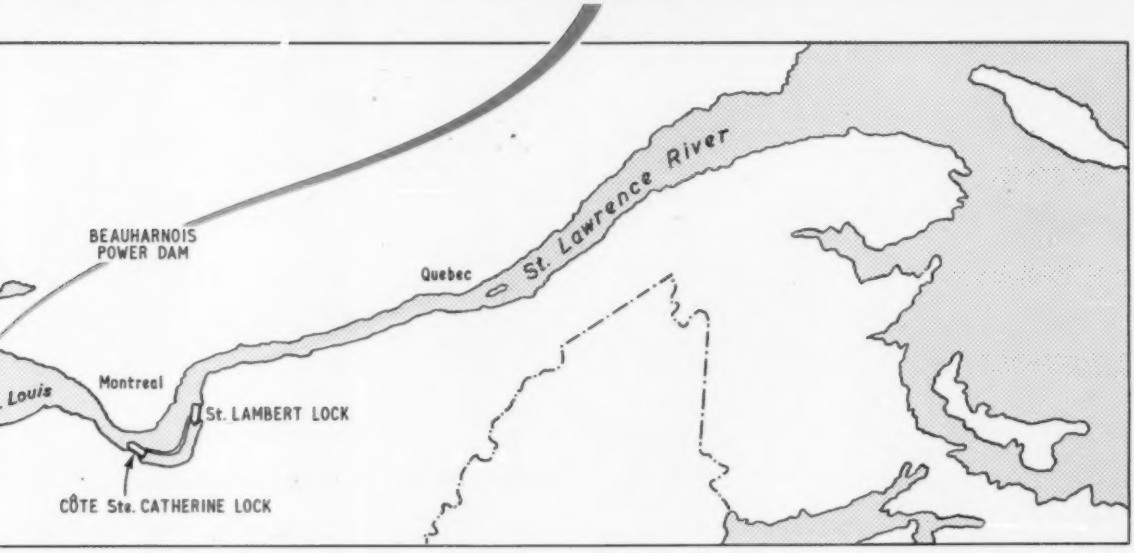




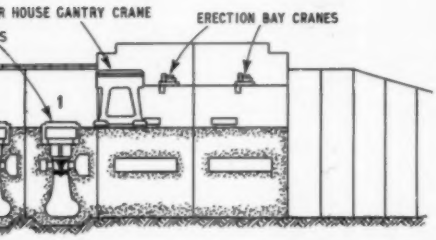
This main map shows the course of the St.
to the sea and indicates the position o
The locks and levels are illustrated i
map. At the top of the page are view
northward to Lake Ontario; the Iroquois
flow from Lake Ontario and the Iroquois
which is used to control the headpond
Lawrence Power House; and the Beauharn

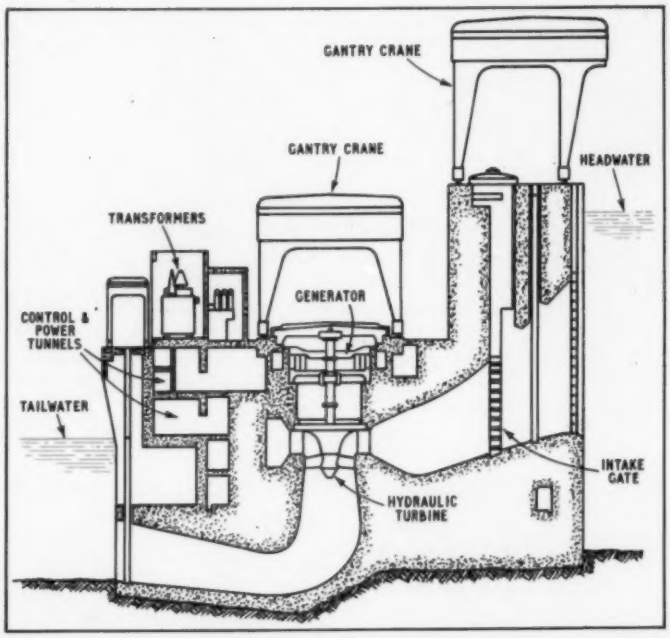


This schematic elevation shows the arrangement of the turbines and generators in the United States and Canadian sections of the main power house. On the left is a vertical section of one of the American sets and on the right one of the Canadian sets.



ows the course of the St. Lawrence from the Great Lakes
ndicates the position of the dams and power houses.
vels are illustrated in the vertical section below the
o of the page are views of the Welland Canal looking
e Ontario; the Iroquois Dam which regulates the out-
ntario and the Iroquois Lock (left); the Long Sault Dam
control the headpond of the power project; the St.
House; and the Beauharnois Power House down the river.





to some 130ft (142ft from headpond level to tailrace) naturally demanded substantial enclosures to contain the waters at this point over what is substantially fairly flat country. This purpose was achieved by concrete dykes, in some instances built back to a distance of about nine miles upstream. These were placed across all valleys and low-lying areas to contain the newly-flooded areas. In some parts, however, low hills provided sufficient high ground to contour the flooded areas. In one position what used to be hilly ground has now become a chain of more than a dozen islands. These were considered to be of sufficient importance to be connected by bridges at both ends to the mainland. They now provide a magnificent viewpoint for visitors from which to see the St. Lawrence basin a short way upstream from the spillway and power house. Railway lines and major roads also had to be moved back in the headpond area.

River Divided into Three

An official start was made on the project on 10th August, 1954. The power houses were officially opened in a joint Canadian-U.S. ceremony which took place on 5th September, 1958. Viewed from the mouth of the river, it can be seen that the task really constitutes the division of the river at the power house site into three paths. That on the south or left has become the Seaway for navigation. The central section is the spillway, while the right-hand path is the power house route.

Twenty-five miles upstream the pattern is repeated, again with three paths being formed. Here, however, there is no power house, and the three paths, from south to north again, are a channel for flood water, a dock for the Seaway, and the Iroquois Dam. In between these projects little is to be seen but water and a new shore line; here, from the construction aspect, dredging has been the most onerous task to provide a suitable channel for navigation and the re-routed water to the power project. While this has been done chiefly in the previous channel of the St. Lawrence, there have been spots where new channels have been dredged across whole islands.

This major task of opening up channels, constructing dams and dykes, building coffer dams, etc., has been carried out without affecting the flow or levels of the river at any point for material lengths of time. Traffic has operated unimpeded through the small canals built previously to by-pass the rapids. This necessitated not only close attention to water levels, but very strict construction schedules at the various sites where work was carried on simultaneously.

Construction of the power house was carried out in the dry by throwing a line of cells into a coffer dam across that portion of the river which was to take the power flow. This coffer dam was erected immediately below the site of the power house. The coffer dam consisted of 66 cells, each more than 64ft in diameter, constructed of sheet steel piling. At this point the river is more than a mile wide and it is believed that this was the largest sheet steel piling coffer dam ever constructed. About 11,900 tons of steel was used on the job, while cribbing material to fill the structure amounted to about 396,000 cu yd. Construction proceeded from both ends simultaneously, although there was no suitable material on Barnhart Island to fill the cells. This had to be built up by a fleet of approximately 80 lorries operating over a distance of eight miles. Divers were almost continuously employed during the building of the coffer dam to secure the proper placing of the piling and to ensure that immersed obstacles did not break the metal seals. Before this an earth dam had been thrown across this section of the river, some three miles further upstream. Between these two obstacles a lake was thus formed. This was pumped dry and work proceeded.

Before the Americans could begin the work on their side, for the construction of the Robert Moses Power Dam, means of access had to be obtained to Barnhart Island in very quick time. This led to the construction of a floating bridge for workmen and material. This was not an easy task on account of the rapid currents in this section of the river. Steel trusses were mounted on railroad car floats, which were anchored by a suspension cable acting horizontally. The situation was complicated by the fact that construction of the steel cantilever bridge was made difficult by ice floes and high currents. However, it was necessary to complete this in time for the temporary bridge to be removed before ice demolished it in the winter of 1955. This would have rendered access impossible until the following spring.

Dewatering of the power station area was completed by June, 1955, and from then on station construction could proceed. The area thus dewatered is immediately upstream of the station and eventually became the headpond of the project. During 1955 work was also proceeding upstream, dredging and excavating channels to provide suitable navigation channels and hydraulic flows.

By midsummer the contractors for the Power Authority of the State of New York had excavation connected with the American power house, and the Long Sault Dam (the spillway) well under way. By the end of 1955 most of the rock and earth excavation for these projects was completed. During 1956 a good deal of transmission line, road and rail alterations were completed. In view of the extensive flooding which was to take place, both the main Toronto-Montreal road and railway had to be relocated on higher ground. By the end of 1957, the permanent structures were in an advanced stage of construction. A start had also been made on installing the plant and equipment in the power house.

Generating Plant

The order for sixteen 75,000 b.h.p. fixed blade propeller turbines, given by the Hydro-Electric Commission of Ontario to the English Electric Co. of Canada, was the largest order ever placed with a single turbine manufacturer. The turbine runners normally operate at 94·7 r.p.m.; they are 21ft in diameter and the diameter of the shaft is 39in. A curious situation arose in connection with the efficiency of these machines. Conforming to a fairly general American practice, the specifications issued by the New York authorities were not definite on this matter. They declared that all turbines showing over 90 per cent efficiency would be evaluated on the same basis. The machines supplied for the Canadian side were guaranteed at 92·5 per cent, and in practice are exceeding this figure. It is expected that they will be several points better than the machines supplied under the American contract.

All this paved the way for the gradual removal of the downstream coffer dam early in 1958, and on 1st July, 1958, the upstream earth dam was breached with thirty tons of explosive. The headpond now filled and the plant was in operation.

The story of the St. Lawrence power project would not be complete, however, without some mention of the fact that the homes of some 6,500 persons were flooded on the Canadian side. Leaving seven small communities, these people were moved to three new towns, constructed on virgin land. Many houses were removed bodily; others were rebuilt; churches, cemeteries and national monuments were moved to their new sites by the end of 1957. All in all, a monumental task, conceived and directed with increasing power demands in mind.

VIEWS on the NEWS

By REFLECTOR

POSSIBLE sites for a nuclear power station in the Isle of Wight have been discussed by Ian Nairn in the *Observer*. One position which the Central Electricity Generating Board has been examining is at Hamstead, situated on a stretch of pastoral coastline on the north of the island. If, says Mr. Nairn, a station was placed here it "would curdle the whole of the Solent." Power station effluent has been said to raise the temperature of rivers to an excessive degree but curdled waters seem to be something new. The possibility of the erection of a nuclear station at Earnley, another site which has been looked at, is regarded by Mr. Nairn with less apprehension. This site is flanked by "bungalow towns" and the writer considers that an atomic power station here would "actually improve the existing view if it were designed to excite, not to depress." So far, at any rate, I have not found the design of nuclear stations depressing.

* * *

Delegates to the recent Electrical Contractors' Conference at Eastbourne were greatly pleased with the way in which Mr. R. A. Joseph put over the summary of his paper on contractors and industrial maintenance. They were particularly amused at his explanation of the brevity of his introduction: that those who had read the paper had no need to be told what it contained, while those who had not did not care anyway. This should be borne in mind by authors who feel impelled to dwell too long upon papers which have been distributed well in advance of their presentation.

* * *

It is notoriously possible to make a case for almost anything, especially as most subjects are neither purely black nor white. In a debate at the contractors' conference both Mr. J. Mortimer Hawkins (for) and Mr. V. J. Stock (against) were able to substantiate their views on the respective merits of independent and grouped concerns, at least to their own satisfaction. In the end the "independents" won, which was not surprising as the majority of E.C.A. members are independent—some would say too independent for modern conditions. Listening to the debate, I regretted that it was restricted to general principles; I think it would have been a great deal spicier if more attention had been paid to recent electrical events. For instance, contractors are very much concerned with cables but I didn't hear the word mentioned.

* * *

There are many domestic electrical jobs which are best left to a qualified electrician, but it is generally accepted that replacement of fuses is one which people can safely do—and generally do—in their own homes if they wish to avoid the inconvenience of being without a supply of electricity. According to *The Times*, however, the E.T.U. apparently thinks that the extension of this accepted principle to school caretakers in Blackpool is wrong and says that the work ought to be done by a qualified electrician. However, in declaring that such practices must cease, it magnanimously says that caretakers may be permitted to change electric light bulbs. I think the reply by Councillor J. H. Smythe, chairman of the Blackpool Education Committee, that "We shall carry on as we have done in the past" is a suitable one.

* * *

Recently the Rochford (Essex) District Council has protested against the erection by the Eastern Electricity Board of an overhead line in its area. Nevertheless the Essex County Council has told Rochford that to put the line underground at an extra cost of between £15,000 and £17,000 would not be warranted. Referring to this at a meeting of the Sutton Parish Council, the chairman said:—

> "It is better to spoil the looks and beauty of the neighbourhood than spoil the land underneath it. Electricity cables would go right across fields, not on the headland, and would spoil the land drains all the way through. It takes years to get them right again."

* * *

In reporting on the new equipment for nuclear fusion research at the Aldermaston establishment of Associated Electrical Industries, Ltd., the *Daily Mail* was unable to make up its mind about the sex of "Sceptre IV." One cutting I have reports:—"Zeta's 'Brother' ready soon" while another of the same date says:—"Enter Zeta's £250,000 sister."

* * *

From a *Kentish Observer* description of a new signal box built at Sittingbourne for the electrification scheme:

> "Once the train has passed the signal it is then automatically replaced. . . ."

As the writer says, the element of risk is reduced to the minimum.

* * *

One of the outstanding qualities of Thomas Alva Edison was his pertinacity, which enabled him to surmount most of the obstacles in his path. An example of this was recounted in the *Electrical Review* of 15th August, 1879:—

> "Recent reports from America state that the one obstacle met with by Mr. Edison at present to the complete success of his electric light is the high price of platinum for his incandescent coil. No other metal will answer, it seems, so Edison has sent off a dozen explorers to California, New Mexico and South America to ransack the gulches, with orders to find a large and constant supply of platinum. If they cannot find it on the surface of the earth, they have orders to proceed straightway to the interior."

Turbo-Alternator Protection

I.—Supervisory Instrumentation and Protection Against Overspeed for Large Steam Turbines

By H. A. KIRBY, B.Sc., A.M.I.Mech.E., Associate I.E.E.,* and D. R. FENWICK, A.M.I.E.E.*

Correct clearances between the rotating and stationary parts of a steam turbine must be maintained under all conditions of operation and the special instrumentation required is discussed. The governing system of a turbo-alternator must incorporate safety devices to prevent any dangerous overspeeding. These are described and the complications due to reheat systems are considered

THE continuing advances in output of steam turbo-alternator units, together with the accompanying adoption of higher stop valve pressures and temperatures, have greatly increased the problems involved in power station operation. To obtain the greatest economy, reheating has become standard for large units and two-shift operation has become increasingly important.

These trends greatly complicate the problems of turbine design and construction. Correct clearances between the rotating and stationary parts of the turbine must be maintained under all conditions of operation, even though temperatures may range from cold up to the maximum, and overall expansions of the order of one inch in length may be experienced.

The rotors of large turbines weigh several tons, and run at 3,000 or 3,600 r.p.m. It will be appreciated that rotor distortions cannot be tolerated if accurate balance is to be maintained, and in illustration of this point it may be mentioned that a displacement of the centre of mass by only 0·004in from the axis of rotation can produce at 3,000 r.p.m. a centrifugal force equal to the weight of the rotor.

Although turbine drivers are skilled in detecting slight changes in the running characteristics of each turbine, the position is now such that on machines operating at advanced steam conditions, special instrumentation is necessary to indicate and, where required, to record the following:—

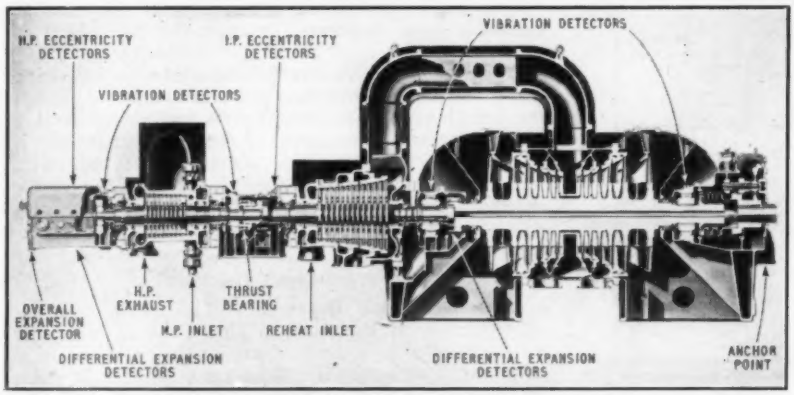
(a) Shaft eccentricity.
(b) Differences in expansion between rotating and stationary parts.
(c) Overall expansion of the turbine.
(d) Vibration in the bearing pedestals.

This instrumentation is of great value during starting —and the trend is towards more frequent starting and stopping as machines are block loaded in shift operation.

When a turbine is cooling after shut-down, natural convection results in uneven temperature distribution within the casing: the interior atmosphere is warmest at the top and coolest at the bottom. Under these conditions, some distortion of both rotor and casing is a natural corollary. To minimise the distortion, modern turbines are provided with turning gear by which the rotor can be turned at low speed while the unit is cooling after shut-down and as a preliminary to starting. Hitherto, low-speed turning has been the common practice, since, with moderate steam conditions, the rotor has been considered the critical element. With advances in unit size and the adoption of higher steam conditions, however, casing thicknesses have considerably increased, and there is a trend towards higher barring speeds. Higher speeds promote circulation of the atmosphere within the casing and so obtain more rapid equalisation of temperature, in transverse planes, for the turbine as a whole.

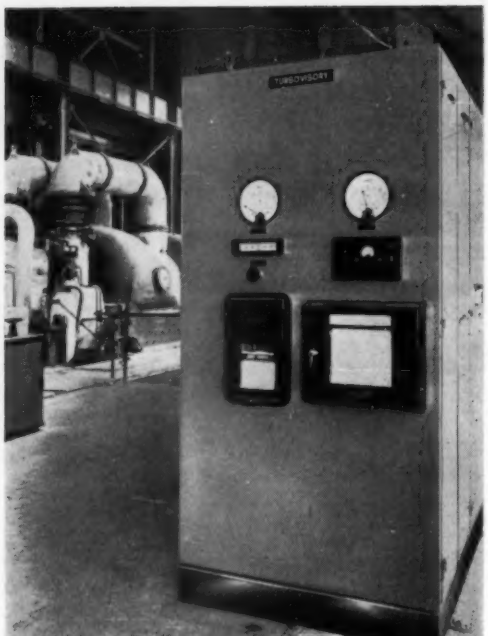
An essential feature of the starting procedure is to check that the rotor is "straight"; that is, the rotor curvature, whether simple or complex, must correspond to the natural gravitational deflection of the rotor system supported in its bearings, so that each transverse section of the rotor will rotate about its centre of mass. If the rotor is not in this condition, it must be turned at low speed, so that it is heated uniformly, and this barring operation must be continued until any residual temporary distortions are removed. The shaft must be true before any attempt is made to run at normal speed.

The control of rotor deflec-



Longitudinal section through a 120 MW reheat turbine showing the positions of turbovisory detectors

* A.E.I. Turbine-Generator Division and Metropolitan-Vickers Electrical Co., Ltd.



Turbovisory cubicle at Chadderton power station

Fig. 1.—Differential axial expansion

(a) Position of detectors (g_1+g_2 = constant). (b) Circuit diagram. Over linear portion open-circuit voltage $\propto Z_1-Z_2$.

Detector circuit current $\propto \frac{\text{open-circuit voltage}}{\text{equivalent impedance (constant)}}$

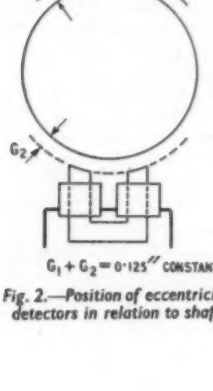


Fig. 2.—Position of eccentricity detectors in relation to shaft

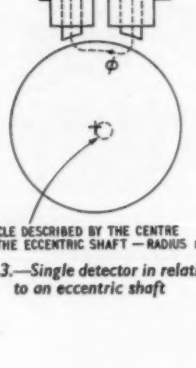


Fig. 3.—Single detector in relation to an eccentric shaft

Differential expansion detector magnets

tion is probably the most significant problem to be faced during starting. Accordingly, the principal requirement for turbovisory equipment is to give the turbine driver adequate warning of incipient distortion before it is aggravated to an appreciable degree. This is particularly important. Continued increase of speed with a shaft out of true can lead to a situation in which correction is beyond control by the time vibration can be felt by the driver, and extensive damage to the machine may ensue.

After eccentricity detection, probably the most valuable aid to operation is an indication of the axial clearances between the moving and fixed parts inside the turbine. The rotor is located axially relative to the casing by means of a thrust collar which is usually adjacent to the portions exposed to the higher temperatures. During the running up of the unit, the rate of heating of the rotor, because of its smaller mass, frequently differs from that of the casings. Consequently, the rotor system and the casings expand at different rates, and all clearances are affected in some degree according to the longitudinal temperature distribution, the distance from the thrust collar, and the different and changing expansions of parts in proximity. When required, provision is made for an independent control of the rate of casing expansion, by means of a separate supply of steam to the horizontal joint. Although the axial clearances most affected are those, usually generous, at the end farthest from the thrust collar, change in the relatively finer clearances, which are usually associated with the highest temperatures, may be the critical factor. Measurement of relative axial movement is therefore desirable at convenient points along the rotor as well as for the turbine as a whole; the measurement also serves to guide the operator when adjusting the flow of joint warming steam.

To permit freedom for expansion, the turbine is anchored at one point to the foundation block. From that point, casings and pedestals in combination are free to slide axially in guides. A smooth continuous overall expansion provides a good indication that conditions are progressing normally, and a recording of this rate of expansion is an important factor in the supervision of operation.

A previous comment may have been taken as suggesting that the recording of vibration is of little benefit. Although the measurement of eccentricity gives preliminary warning of vibration as a consequence of shaft distortion, there is a school of thought which considers that the direct measurement of vibration itself is valuable, since the detection of vibration at the earliest possible moment may give advance warning of the onset of bearing trouble.

Operation of Turbovisory Equipment

Differential Axial Expansion. The measurement of differential axial expansion is simple: it involves the employment of a variable-inductance bridge in the form of a pair of detector electromagnets connected in series and shunted by a centre-tapped resistance. The detector magnets are rigidly fixed to the turbine casing, with their

poles opposed, on each side of a collar, coupling, or other suitable part of the rotor, as in Fig. 1 (a). A difference in movement of rotor and casing increases one air gap and decreases the other by a similar amount. The bridge is excited by a high-frequency generator, and the air gap is so proportioned that the required range is covered by the central, and therefore linear, part of the bridge characteristic, as referred to in Fig. 1 (b).

In practice, the detector circuit is biased so that zero differential expansion corresponds to a finite output from the bridge. The arrangement is such that rotor expansion relative to the casing circulates an increased current in the detector circuit, and rotor contraction decreases the current.

Shaft Eccentricity. The measurement and recording of shaft eccentricity at a suitable position on the turbine is carried out by using, as a detector, a pair of electromagnets excited by the same high-frequency generator as employed for differential axial expansion. These electromagnets are diametrically opposed across the shaft, and are rigidly fastened to a bearing pedestal, as shown in Fig. 2. As it is important to know the truth of the shaft at low speed, as well as at higher speeds, the amplifying equipment following the detectors is arranged for two methods of operation. The first, known as "turning gear" operation, is used during the barring of the turbine at low speeds: the second method, known as "steam" operation, caters for speeds above this level. They are dealt with separately in the following paragraphs.

Fig. 3 shows a single eccentricity detector electromagnet mounted in relation to an eccentric shaft, the centre of which describes an eccentric circle of radius "r." The coils are energised by the high-frequency generator, and each forms an impedance in which the magnet path includes, in series, the core, the turbine shaft, and the two air gaps. As the shaft rotates, the air gaps vary with the transverse displacement, so that the carrier current flowing through the coils is modulated as a function of shaft eccentricity and speed, as shown in Fig. 4 (b). The basic circuit employed to convert the signal to a form suitable for the indicator and recorder is given in Fig. 4 (a): the operation may be followed by referring to Fig. 4 (b) to (f). Fig. 4 (b) shows the nature of the modulated current fed to the full-wave rectifier. It appears at the terminal A of the load resistance, as shown in Fig. 4 (c). The resistance is followed by a low-pass filter which removes the high-frequency components, leaving the low-frequency modulation due to the shaft eccentricity unaffected, as in Fig. 4 (d). This voltage is applied to the grid of a cathode-follower valve in which the output appears across the cathode load. The form of the voltage appearing across the cathode load is shown in Fig. 4 (e), and is similar to the input voltage, but the d.c. component is increased due to the standing current through the valve. The grid voltage and cathode load of the comparator valve are adjustable to permit variation, for calibration purposes, of the standing current through the instrument and recorder.

With the above arrangement, at barring speed, the instrument pointer and recorder pen move in synchronism with the shaft displacement, and the resultant record appears as a narrow band on the chart. Should the shaft bend, the width of the recorded band increases.

At normal running speed, the recorder pen is not able to follow current modulations corresponding to shaft eccentricity, and it is necessary to convert the modulation depth into an equivalent steady direct current. The basic circuit is shown in Fig. 5 (a). Up to point B in the circuit, the conditions are the same as for "turning gear" operation, as described above: the a.c. component of the voltage at this point is proportional to eccentricity. By interposing a series capacitor, the d.c. component is removed and the a.c. component fed on to the grid of the cathode-follower valve. The output appears as a voltage across the cathode load, as shown in Fig. 5 (c). The d.c. level of this output at point D is independent of displace-

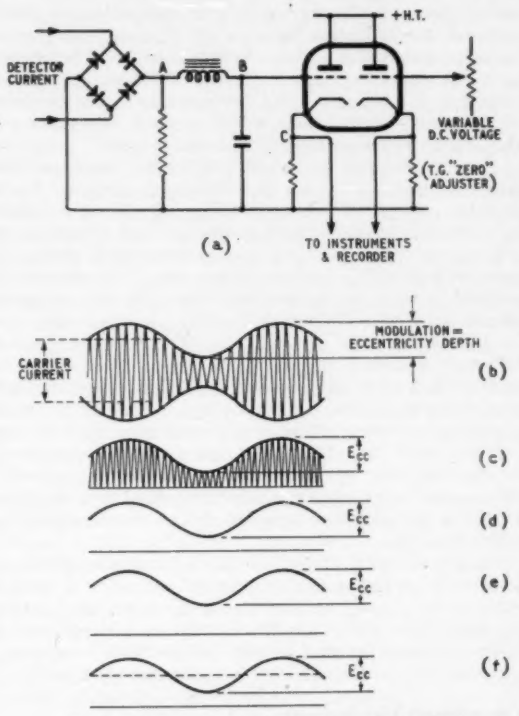


Fig. 4.—Shaft eccentricity ("turning gear" operation)

(a) Basic circuit diagram. (b) Detector coil circuit. (c) Rectified voltage at A. (d) Voltage at B. (e) Voltage at C. (f) Recorder current (d.c. level dependent on "displacement")

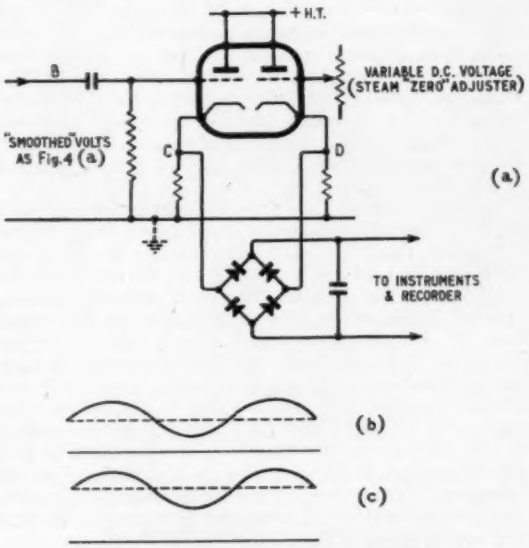


Fig. 5.—Shaft eccentricity ("steam" operation)

(a) Basic circuit diagram. (b) Voltage at B (d.c. level dependent on "displacement"). (c) Voltage at C (d.c. level independent of "displacement")

ment, and by adjustment is made equal to that at point C. Thus, by taking the output from points C and D, and passing it through a full-wave rectifier, a direct current proportional to the eccentricity is measured by the indicating instrument and the recorder.

Overall Expansion. The axial movement, relative to the foundation of the bearing pedestal remote from the anchor point, is transmitted by rack and pinion, or other suitable means, to the driving shaft of a toroidal potentiometer included in a simple bridge circuit. The bridge circuit is energised from a constant d.c. supply: it is so arranged as to give a signal proportional to the position of the potentiometer shaft, which is itself dependent on the degree of overall expansion of the turbine.

Bearing Pedestal Vibration. Vibration detectors are mounted transversely on the bearing pedestals. Each detector consists of a mass of laminated soft iron which is suspended from flat springs between the pole faces of a U-shaped laminated core, so that freedom of motion is permitted in the transverse plane only. A permanent magnet is fixed to the detector base, and the magnetic circuit is completed through the soft iron mass and core around which coils are wound. When mounted on a vibrating pedestal, the soft iron mass remains in one position so long as the resonant frequency of the mass and suspension springs is not approached. Accordingly, with a pedestal vibrating, there is relative motion between the soft iron mass and the core so that a signal proportional to the amplitude of vibration is generated in the coils. After rectification, this signal is transmitted to a recorder which is sequentially connected by automatic switching to the detectors.

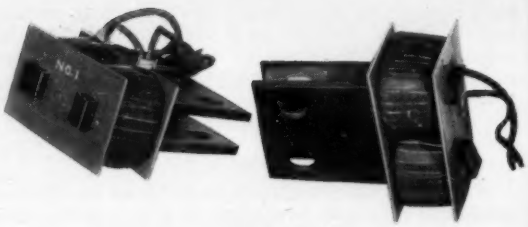
Speed and Load. To obtain a more complete operating history, it is becoming increasingly common to record both speed during starting and generator output when on load. The measurement of speed is derived from a tacho-generator coupled to the turbine shaft: measurement of load is obtained from a wattmetric device.

Overspeed Protection

It is essential for the governing system of a turbo-alternator to incorporate safety devices to prevent any dangerous overspeeding of the unit. It is also highly desirable for the construction of all steam valves and their operating mechanisms to permit routine tests to be made, even with the machine on load, to establish that the valve gear is in perfect working condition and that the valves are free to close in any possible emergency. Similarly, it is desirable that the operation of various safety devices should be checked as a standard procedure, either as a preliminary to going on load or after removal of load before shut-down.

Emergency Trip Gear. A turbo-alternator unit normally operates in parallel with others in an interconnected system: speed is held constant by the system frequency, and the load carried by the machine is altered by using the speeder gear. In most modern machines, speeder adjustment, transmitted hydraulically by a sensitive oil or pilot oil system, operates oil relay valves controlling hydraulic power cylinders which open or close the governor valves: similarly, hydraulic power cylinders are used to open the emergency valves. The oil for relay and power cylinder operation is taken from the delivery of the main oil pump. Hence, it is convenient to pass the oil supply to the sensitive oil system, and to the emergency valves, through a main emergency trip valve that is operated by the overspeed governor or by local and remote trip controls.

A simple, but typical, emergency trip mechanism is shown in Fig. 6. Duplicate emergency overspeed



Eccentricity detector magnets

governors, or safety governors, of the eccentric ring type are shown. Each of the rings, which are carried on an extension of the turbine rotor within the end pedestal, has its centre of gravity displaced from the axis of rotation. At normal speed, the rings are held in position by springs, but, above normal speed, centrifugal force overcomes the spring compression and the rings move radially to sweep a circular path of larger diameter until they strike a trigger lever.

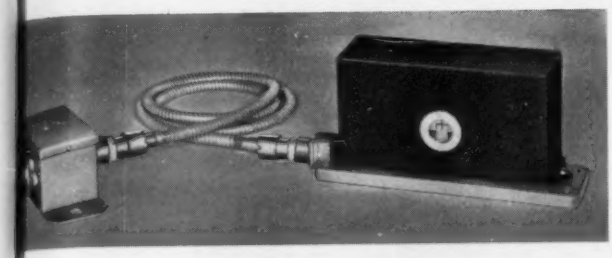
The main emergency trip valve is fitted inside the turbine end-pedestal. It consists of a spring-loaded double piston within a ported sleeve fixed inside a chambered casing. The upper chamber of the casing is connected to the relay oil system and the lower chamber is open to the oil drain. In normal circumstances, the spring holds the piston at its upper limit of travel, and allows relay oil to pass freely through the ported sleeve from the upper to the middle chamber, and thence to the relay system. If the piston is pushed down against its spring, the upper ports are covered, cutting off the supply from the pump, and oil from the middle chamber has a free passage through the middle and lower ports to the bottom chamber, and thence to drain.

A small vertical spindle rests on the top of the trip valve piston, and passes through the casing to butt against the lower end of a larger vertical push-rod in a guide. The upper end of the push-rod registers against the underside of a rocker lever which is keyed to a shaft supported by the pedestal cover. The other end of the rocker lever is linked to a spring-loaded rod mounted in the pedestal. A pair of latching levers—one keyed to the shaft of the rocker lever and the other keyed to the splined shaft of the overspeed governor trigger lever—interlock to keep the trip spring in compression and to allow the trip valve spring to hold the valve open to the relay oil supply.

The latching lever on the trigger lever shaft registers against a pin on the hand trip lever, which is pivoted on the casing. The hand trip lever is also linked to the moving element of a solenoid. If the hand trip lever is raised manually, or by the solenoid, the pin strikes the latching lever and disengages it. The spring tension of the emergency governors is adjusted so that at about 10 per cent above normal speed, the rings strike the trigger lever which also releases the latch. In either event, the powerful trip spring forces down the emergency trip valve, the relay system is isolated from the oil supply, and at the same time oil in the relay system is released to drain, which causes the emergency valves to close immediately; the accompanying collapse of oil pressure in the sensitive oil system causes the governor valves to close also.

When the hand trip lever is pushed down after tripping, the pin engages a projection on the latching lever keyed to the rocker shaft, the trip spring is again compressed, the latching levers interlock and the oil trip valve rises to its normal position.

A selector lever on the pedestal has a spring-loaded stop pin that engages with any of three holes in the



Vibration detector

pedestal casing. With the pin in the middle hole—the position for normal operation—both overspeed governors are in service. Engagement of the pin in either of the outer holes moves the trigger lever along its splined shaft so that it is opposite one or the other overspeed governors. The operation of each governor can thus be tested independently.

Any requirement for on-load testing of the overspeed emergency governors would necessitate means of increasing the centrifugal force of the eccentric rings without, at the same time, increasing turbine speed. This can be effected by using hollow rings and injecting oil for test purposes to increase the out-of-balance weight. Provision has to be made, of course, to ensure that the emergency and governor valves do not close while the overspeed governor is being tested on load.

Reheat Considerations. Although the overspeed governor is the limiting safety control, the temporary rise in speed resulting from a sudden removal of full load—for example, due to a system fault—should not be sufficient to trip the machine. Since the emergency trip mechanism is normally set to operate in the region 10 to 12 per cent in excess of rated speed, the governing system must be capable of restricting the temporary speed rise to an excess of not more than 8 to 9 per cent.

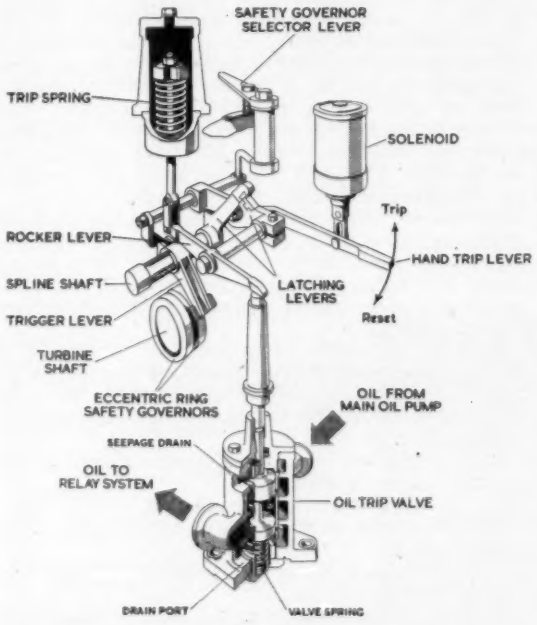
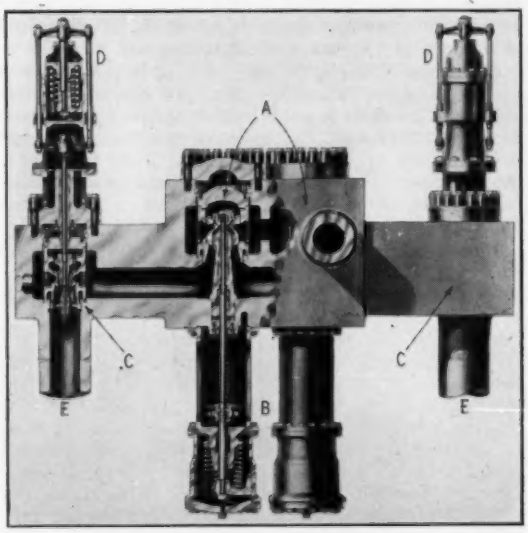


Fig. 6.—Perspective diagram of trip gear

Designing the governor gear to meet this requirement for non-reheating condensing turbines does not normally present any great difficulty. The loop pipes between steam chests and cylinder, if the chest is not integral with the cylinder, do not normally contain a sufficient volume of steam to produce an excessive temporary speed rise. Reheat machines, on the other hand, require long steam pipes of relatively large bore to carry the steam to and from each reheater, and therefore inevitably present special problems due to the large volume of steam entrained in this piping and in the reheat sections of the associated boiler plant. Interceptor governor valves are fitted to prevent this steam from expanding through the turbine stages. These valves will close if load is suddenly lost from the turbine. Usually an interceptor emergency stop valve is also provided in series with each interceptor steam chest. On tandem machines, these valves are situated in the piping between the reheater outlet and the turbine inlet, as close to the turbine as practicable. In constructions where the initial stages of expansion after the reheat inlet are housed in the h.p. cylinder, the interceptor valves may be in the connections between cylinders, or in a chest integral with the i.p. casing.

Interceptor governor valves are normally fully open at rated turbine speed, but are closed when the speed has risen to a predetermined value, which may be in the range 4 to 5 per cent above the rated speed. It is possible to arrange for these valves to remain fully open until the predetermined overspeed is reached, and then to close immediately. Alternatively, and desirably, the valves may be arranged to start closing at about 2 per cent above rated speed, and to be fully closed at an overspeed of 4 to 5 per cent. For the latter arrangement, the governor gear is more complicated, but the fact that the valves start closing at a lower overspeed is an advantage. Interceptor governor valves may be controlled, through a second sensitive oil system, by the same centrifugal governor as controls the h.p. inlet valves; the elimination of an additional centrifugal governor and its drive facili-



High-pressure steam chest for a 200 MW reheat turbine. The combined isolating and emergency stop valves are in parallel to permit independent on-load testing of their operating gear, and have common connections at inlet and discharge

A. Combined isolating and emergency stop valve. B. Emergency valve power cylinders. C. Governor valves. D. Governor valve power cylinders. E. Bifurcated connections to turbine inlets

tates a simpler pedestal layout. The range of speed rise required to close the interceptor governor valves can be selected without regard to considerations of load distribution and stability of governing.

Emergency interceptor valves provide additional protection. They are supplementary to the interceptor governor valves, and operate simultaneously with the h.p. emergency valves. They remain fully open until complete closure is required, and are controlled by the same overspeed trip as operates the h.p. steam emergency stop valves.

In some turbine designs, arrangements are made to discharge steam, under emergency conditions, from the reheater system directly to the condenser by means of specially provided valves and piping. This method is open to criticism because complication is caused by the additional piping and the connections to the condenser, and leakage through the valves could result in a serious loss of efficiency.

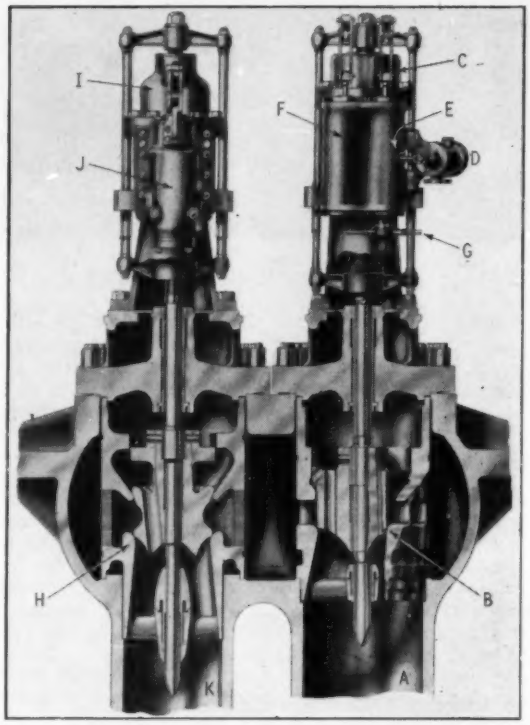
In reheat machines, with both h.p. and the initial i.p. turbine stages in opposed flow within the same casing, leakage steam from the h.p. gland enters directly into the stages situated after the reheater, without coming under the control of any intermediate valve. Admittedly, under emergency load throw-off conditions, the steam from the h.p. cylinder leaking through the gland could contribute to the temporary speed rise, but the rate of gland leakage, which decreases as the pressure in the h.p. cylinder falls, is hardly sufficient to justify special precautions. There have been instances, however, where turbines of this type have been provided with a gland leak-off controlled by a valve which opens automatically in the event of a sudden loss of load.

Two-line reheat units, simply cross-compounded with the reheater connected between the two axes, are preferably equipped with governor and emergency valve control systems on each line. This arrangement enables either axis to be run independently of the other so far as governing is concerned. When the two lines are running together as a single machine, the h.p. governing system controls the output, and the valves on the l.p. axis serve as interceptor governor and emergency stop valves.

Overspeed Limiting Gear. An additional form of protection against excessive overspeed due to a sudden major or complete loss of load is fitted to most large turbines. This device is termed overspeed limiting gear: it is designed to detect the conditions likely to result in overspeeding, and to close the emergency valves immediately, so limiting, by anticipation, the magnitude of the temporary speed rise.

Most emergency valves are operated by a hand wheel or by a remotely controlled motor, either of which positions a pilot valve controlling the admission of relay oil beneath a spring-loaded power piston coupled to the steam valve: each emergency valve is thus opened, and held open, against the force of a strong compression spring by the pressure of oil in the relay system. The pilot valve mechanism is usually spring-loaded, and incorporates an oil trip. Any loss of relay pressure, due to any cause, immediately repositions the pilot valve, and opens the power cylinder directly to drain: the emergency valve closes very rapidly under the influence of the spring.

In Metropolitan-Vickers' practice, each emergency valve has its oil relay pilot valve paralleled by a plunger linked to a solenoid which is energised by a contactor, the operating coil of which is in series with two contacts. One of these contacts is associated with a wattmetric relay and controlled by the generator load, whilst the other is controlled by steam pressure at a chosen stage in the turbine. The former is closed over the range 0 to 30 per cent load, and the latter is closed when the steam pressure is in the range 60 to 100 per cent of its value at maximum load: the settings are adjustable to suit the characteristics of individual units. Should the load on the machine fall suddenly to less than 30 per cent, the load-operated contactor closes, but the pressure-operated contactor does not open immediately because steam already in the system continues to expand: with both contactors closed, the emergency valve solenoids are energised; oil is released from the power cylinders; and the emergency valves close rapidly under the influence of their springs. They thus close more rapidly than the governing system can respond to the change in load and close the governor valves. The emergency valves remain closed until falling pressure or restoration of load opens one or other of the contactors, and the machine is returned to normal control.



A typical interceptor steam chest for a reheat turbine

A. Connection from reheater. B. Interceptor emergency valve. C. Emergency valve power cylinder. D. Trip cylinder. E. Oil relay pilot valve. F. Overspeed limiting gear solenoid valve. G. Operating hand wheel. H. Interceptor governor valve. I. Governor valve power cylinder. J. Oil relay pilot valve and sensitive oil receiver. K. Connection to turbine reheat inlet

In station operation, of course, load is reduced in relatively small steps, or progressively, by operation of the speeder gear, and the pressure contact opens before the load contact closes: the emergency valve solenoids are thus not energised.

In the design and operation of overspeed limiting gear, the following are significant:—

(a) The instant at which load is removed.

(b) The instant at which the emergency valves commence to close.

(c) The instant at which the emergency valves are fully closed.

Load throw-off tests, using oscilloscope equipment, have shown that the time interval between (a) and (b) is usually greater than that between (b) and (c). A design

objective, especially when considering gear for reheating machines, is therefore to decrease the interval (a)-(b). As a measure of this objective, it may be noted that the total period (a)-(c) for a 60 MW non-reheating machine is of the order of 0·35 sec.

Testing Steam Valves. It has already been stressed that it is important to carry out frequent and regular checks of the operation of the governing mechanisms, and particularly of the steam valves, to ensure that there is no sticking or jamming between surfaces which should move freely relative to each other. That steam valves are free to move can be tested only by actual closure, and turbines now in the course of manufacture have full provision for such checks.

In Metropolitan-Vickers' practice, h.p. governor valves are fitted with adjustable fulcrums for the relay levers. For on-load testing, each valve may be closed in rotation by adjusting the fulcrum to alter the position of the sleeve of the oil relay pilot valve so that it cuts off the supply of relay oil to the power cylinder and opens the cylinder to drain. Each interceptor governor valve is provided with a testing valve which can isolate the pilot valve receiver unit from the sensitive oil system and, by draining the receiver, cause the governor valve to close.

Where the discharge from the h.p. emergency valves is not common to all governor valves, freedom of movement of individual emergency valves can be checked by the normal operating gear only at no-load or at low loads. On-load testing is possible so long as the accompanying governor valves are also closed before any attempt is made to re-open the emergency valve. For the latest machines, the h.p. emergency valves are in parallel with a common discharge to the governor valves, and each may be tested separately on load. Interceptor emergency valves can be closed by their operating gear.

At no load, a hand-operated contactor in parallel with the steam pressure operated contactor can be closed to energise all emergency valve solenoids to test the overspeed limiting gear and, incidentally, the closing of all emergency valves. When trip gear or safety governor routine tests are carried out at no load, station staffs should make certain that all emergency and governor valves close automatically and completely.

Conclusion

Considerable effort has been devoted to the development of equipment that, by detecting incipient troubles, will aid correct operation. Equal care has been given to the design of safeguards to protect the machine and the station staff. No device, electrical or mechanical, can ever be perfect, but the intelligent interpretation of readings from indicators and recorders, together with a well-planned checking routine, will ensure a practical approach to the ideal of maximum availability and utmost reliability.

MINING ELECTRICAL AND MECHANICAL ENGINEERS

Annual Convention at Newcastle-upon-Tyne

IN his presidential address at the annual Convention of the Association of Mining Electrical and Mechanical Engineers at Newcastle-upon-Tyne (to which brief reference was made in our 19th June issue) Mr. E. Loynes took as his subject "Technicians in Engineering and Mining." He said that technicians were probably five times as numerous as professional engineers generally, and even more so in the mining industry. They must first become skilled craftsmen, with basic training in fully equipped centres and advanced training in central workshops. Systematic training in the proper methods of testing, inspection and fault diagnosis was a necessity, and subsequent intensive refresher courses in more advanced work and the latest developments were equally essential for adult qualified technicians.

In connection with the degree of academic attainment required, Mr. Loynes said that since the I.E.E. was closing its doors on the National Certificate route to corporate membership, those with General and National Certificates of Education would have to look to other associations or institutions to establish their professional qualifications.

On the following afternoon (10th June) the first part of a paper entitled "Mechanical Handling Underground" was read by Mr. T. E. Green, chief traction engineer, National Coal Board, and Mr. N. Higginson, divisional mechanical engineer, West Midlands Division, N.C.B. The tendency towards the increased concentration of face working, with improved machinery and methods enabling a greater quantity of coal to be produced, makes the haulage of coal from the pit face, and the transport of machinery and equipment to it, of paramount importance. The paper discussed the application and some of the problems arising from the use of the various techniques employed, from conveyor belts to rope haulage, and the use of diesel and electric underground locomotives.

During the day the ladies enjoyed an all-day coach tour of Northumberland, including a visit to Alnwick Castle, and in the evening a civic reception was given by the

At the annual general meeting, left to right: Messrs. J. Anderson (hon. treasurer and new vice-president), W. Wetton (general secretary), E. Loynes (new president), S. Winstanley (retiring president) and J. E. Ridley (past-president)

Left: Mr. H. T. Ramsay was presented with the W. M. Thornton Medal by Mr. E. Loynes after giving this year's Memorial Lecture. Right: Messrs. T. E. Green (standing) and N. Higginson who presented a paper on "Mechanical Handling Underground"

Lord Mayor and Lady Mayoress of Newcastle in the Old Assembly Rooms, followed by dancing. On 11th June the annual golf tournament for the Heyes Trophy was held at the Gosforth Golf Club, and a number of visits to nearby works took place, while the ladies saw the works of either Patons & Baldwins, Ltd., makers of P & B wools, Joshua Wilson & Bros., Ltd., food manufacturers, James A. Jobling & Co., Ltd., makers of "Pyrex" glassware, or Thomas Hedley & Co., Ltd., soap manufacturers.

Members visiting the works of A. Reyrolle & Co., Ltd., saw flameproof air-break switchgear for coal face duties and metalclad horizontal-draw-out oil-break switchgear for voltages up to 6·6 kV, the manufacture of instruments and protective relays, and further examples of the company's range of switchgear including small-oil-volume and air-blast units for transmission lines up to 380 kV. In the works of C. A. Parsons & Co., Ltd., the group saw the research and design building, the turbo-generator erection bays, stators and rotors being wound and assembled in the generator shop and the construction of all types of transformer up to e.h.v. units rated at 210 MVA.

Visitors to Swan Hunter & Wigham Richardson, Ltd., saw a shipyard having a continuous river frontage of 4,000ft and covering an area of nearly 80 acres. In the 78ft high main prefabrication shed are four large submerged arc automatic welding machines for fillet and butt welding at high speed, and in the plate shop are rolls handling steel plates up to 2in thick. The party then visited Victor Products (Wallsend), Ltd., to see the production of rotary mining drills and percussive equipment, flameproof plugs, sockets and couplers, and flameproof, weatherproof and dustproof lighting fittings.

At the factory of Hugh Wood & Co., Ltd., great interest was taken in the range of flameproof electrical equipment for mines, including gate-end panels, switchgear and relays, plugs, sockets and connectors. This group then saw the works of Wright Anderson & Co., Ltd., who design and erect the steelwork for such applications as power stations, cranes, towers and pylons. The day was concluded by an informal dinner and dance.

The W. M. Thornton Memorial Lecture was delivered on 12th June by Mr. H. T. Ramsay, director of the Safety in Mines Research Establishment, who dealt with international mines safety research. More than 90 million explosive charges were electrically fired each year in British mines, he said, and although the accident rate was low, efforts to achieve complete safety continued.

In dealing with firedamp explosions, Mr. Ramsay considered the subject of electrical ignition. A firedamp-air mixture could be ignited by electrical energies in the region of one millijoule or less, but Prof. Thornton and others found it possible to modify low power systems so that the arcing arising from their operation could not ignite gases, this protection becoming known as "intrinsic safety." High power equipment could not yet be made intrinsically safe, and flameproof enclosures were required, based on the principle that hot gases and flame from an explosion could be passed through an orifice without igniting any external inflammable mixture. Work on the development of these enclosures had led to the use of "stepped" or "angled" flanges, and the discovery that under certain conditions steel flanges were less inducive to ignition than those of light alloy. The gap between flanges might be increased momentarily by an internal explosion, reducing the safety, and in Great Britain a vessel in which the two halves were held together by a pre-stressed system, so that an explosion changed the stress and not the gap, had been developed.

E.R.A. REPORTS

Cartridge Fuse Arcing.—Report Ref. G/T302, "The Selection of Test Currents and Closing Angle Corresponding to the Maximum Arc Energy in Cartridge Fuses (440 V a.c. Tests)" by H. W. Baxter, price 12s 6d, continues the work reported in Ref. G/T246. The object of this investigation was to determine the prospective current corresponding to maximum arc energy and to ascertain if this current bears any simple relation to that corresponding to maximum inductive energy. It was also desired to determine for a given prospective current, the circuit closing angle corresponding to maximum arc energy. At present the only British Standards that mention the closing angle are B.S. 88:1952 and B.S. 1361:1947. Both specify that the circuit shall be made at a rising voltage of 50 per cent of the peak value, corresponding to a closing angle of 30 deg after voltage zero. The more recent standard B.S. 2692—for high-voltage fuses—stipulates that arcing shall commence on an increasing circuit voltage between the values of 50 and 100 per cent of the peak value of the applied voltage, corresponding to an arcing angle between 30 and 90 deg. All values of closing angle and arcing angle in this report are quoted with reference to the circuit voltage.

Heat Pumps.—Report Ref. Y/T22, "Heat Pump Operation in Great Britain—Practical Aspects with Particular Reference to the Shinfield Experiments" by M. V. Griffith, price 24s, discusses the use of heat pumps which save fuel in appropriate circumstances but have a higher capital cost than competing systems. The 10 h.p. Shinfield heat pump warms a laboratory building and uses the ground as principal heat source. The results obtained are compared with those for a similar building heated from a gas boiler. The system has been thoroughly investigated for four consecutive seasons and very little maintenance has been required.

The report says that there are many possibilities for future development and the electrical industry would be well justified in developing the heat pump as an alternative to solid or liquid fuel heating.

Copies of these reports are available, at the prices indicated, from the Association at Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

Particle Accelerator

12 MeV TANDEM VAN DE GRAAF ACCELERATOR AT ALDERMASTON

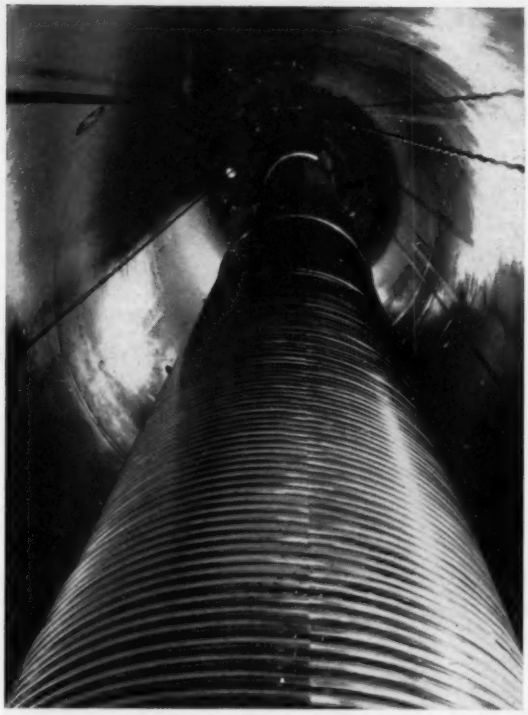
Much basic research work has been carried out by the Atomic Weapons Research Establishment into the mechanics of nuclear reactions. To carry out this programme it is first necessary to produce a beam of fast charged particles. The new 12 MeV tandem accelerator has the advantage that the energy can be easily controlled

THE largest particle accelerator of the electrostatic type was shown recently at the first Press visit ever to be arranged to the Atomic Weapons Research Establishment of the United Kingdom Atomic Energy Authority at Aldermaston, Berks. Two other smaller accelerators and associated equipment were also on view. The use of these machines is part of the Authority's programme of fundamental research into the structure of the atom and is aimed at determining the exact nature of the interaction of neutrons and charged particles at different speeds with a variety of nuclei.

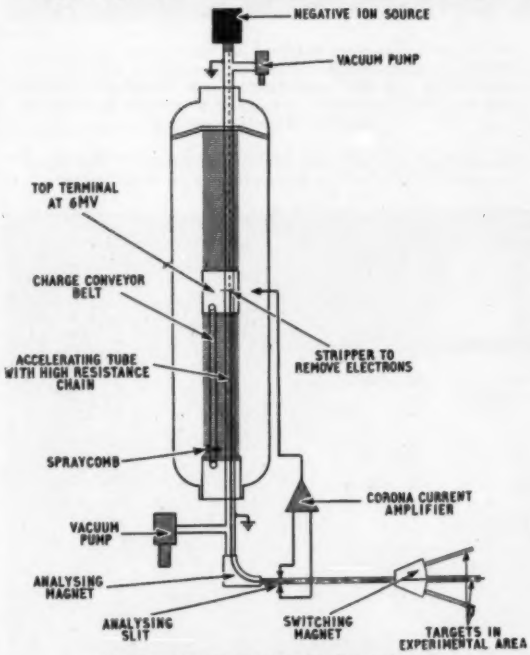
The part played in this programme by the A.W.R.E. is being carried out by the Nuclear Physics Research Division which was formed in 1955. The primary function of this Division is to supply technical data required for the weapons programme and, so that these nuclear quantities could be measured, it was necessary to set up several machines for achieving nuclear transmutations. Thus at the same time as data are obtained of importance to the defence programme, the measurement of the same nuclear quantities are of interest in other fields of activity such as the design of fission reactors.

To study nuclear reactions induced by fast neutrons in the laboratory, it is necessary to produce a beam of fast charged particles from a nuclear machine. In 1932, Cockcroft and Walton produced a directed beam of protons by a condenser/rectifier arrangement but for accurate control and precision required for testing theories of nuclear reaction, an electrostatic generator is better suited.

To produce a directed beam of many microamps of charged particles of controllable energy, the gas, the nuclei of which it is required to accelerate, is ionised by radio frequency discharge. The particles from this ion source are directed through the exit channel by a positive voltage. After suitable focusing they enter a long evacuated accelerating tube which has a stabilising voltage of several million volts, positive at the the ion source end and earthed at the other end, applied to it. This voltage is produced by an electrostatic process. An endless belt of insulating material is rotated at high speed within the length of an insulated stack. At the top of the stack is a polished dome which acts as a top terminal and contains the ion source. At the lower end of the belt is placed a spraycomb from which, by an inductive process, a continuous corona discharge takes place on to the belt, which acquires a positive charge. This charge is carried up to the top terminal where it is removed by wire gauze; thus



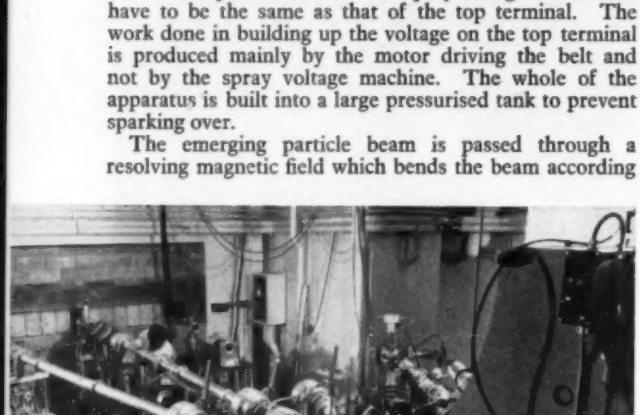
Inside the pressure vessel containing the column supporting the high voltage terminal in the tandem electrostatic accelerator



Schematic diagram of electrostatic accelerator

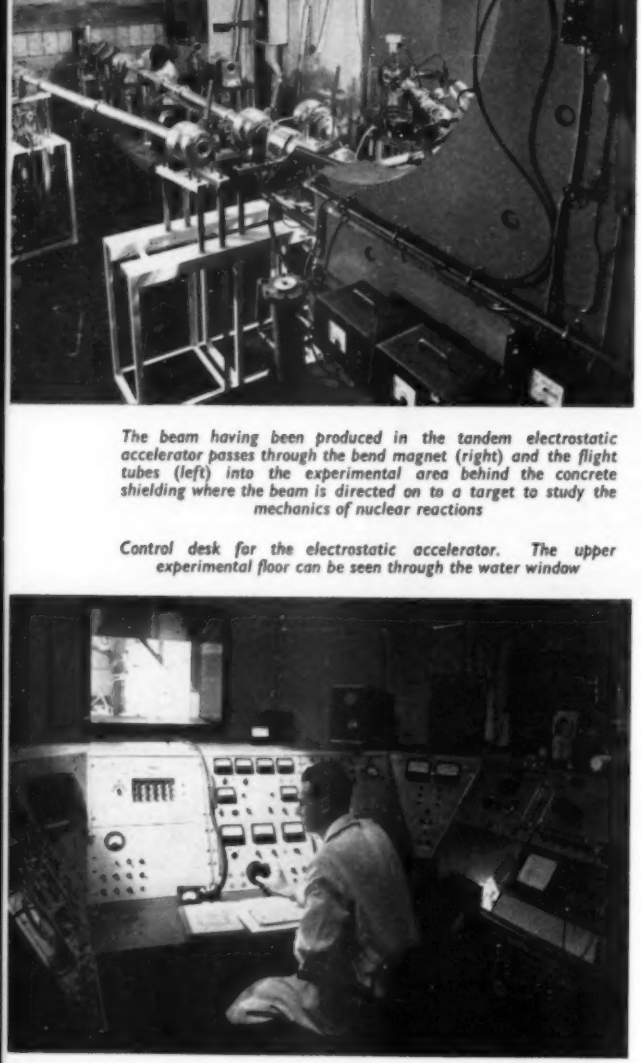
the top terminal becomes positively charged and unless the charge is removed the voltage increases steadily. The charge is, however, drained slowly to earth down a high-resistance chain and produces the voltage required to accelerate the beam. The voltage of the top terminal is maintained at a controllable steady value of several million volts, determined by the current sprayed on to the lower end of the belt, and is used as the power supply to the ion source. The charge cannot be sprayed directly on to the top terminal since the spray voltage would then have to be the same as that of the top terminal. The work done in building up the voltage on the top terminal is produced mainly by the motor driving the belt and not by the spray voltage machine. The whole of the apparatus is built into a large pressurised tank to prevent sparking over.

The emerging particle beam is passed through a resolving magnetic field which bends the beam according to the particle energy. Unwanted particles are rejected and the beam, which passes through a narrow slit after deflection, is well defined in energy. The maximum voltages which can be reached in a system of this type and reasonable size is about 6 MV and the stability attainable is about 2 kV. Well-established energies up to 6 MeV may be reached in the conventional type of machine. However, energies of 10 MeV upwards are required for studies of heavier materials and these can be obtained by a modification of the electrostatic generator which enables charged particles of energies of up to 12 MeV to be obtained. In 1956, it was decided to build two of these Tandem generators in this country, one for Harwell and one for Aldermaston. The one at Aldermaston was put into operation a few months ago and its manufacture cost about £200,000 (exclusive of design work).



The beam having been produced in the tandem electrostatic accelerator passes through the bend magnet (right) and the flight tubes (left) into the experimental area behind the concrete shielding where the beam is directed on to a target to study the mechanics of nuclear reactions

Control desk for the electrostatic accelerator. The upper experimental floor can be seen through the water window



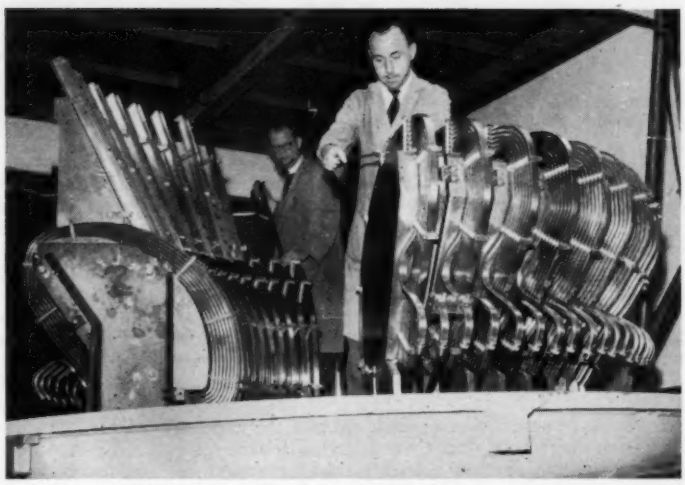
In the Tandem machine, a beam of low-energy negative hydrogen ions is injected into one end of an accelerating tube earthed at both ends with a high potential at its middle provided by an electrostatic generator. The negative ions are accelerated to an energy of 6 MeV at the centre of the tube and, if a thin foil is placed at this point, most of the negative ions will be stripped of electrons and converted to either positive ions or neutral atoms. The stripped ions only are further accelerated down the second half of the tube to reach a total energy of 12 MeV at the bottom. In this way, controllable energies up to 12 MeV are obtained by the use of voltages no higher than 6 MV. Experiments are at present being carried out at Aldermaston at an energy of up to 10·3 MeV. Such energies have previously been attainable only in cyclotrons the energy of which cannot easily be varied. Another advantage of the Tandem machine is that the ion source, being at earth potential, can be built outside the tube and so can be made on a more elaborate scale than that of the orthodox machine.

The Tandem machine at Aldermaston is contained in a pressure vessel 45ft high by 9ft internal diameter and works at a tank pressure of 200 p.s.i. It is installed in a special building 108ft high.

In some of the experiments carried out with these particle accelerators, the charged particles emitted when the charged nuclei are bombarded with other charged particles can be examined. The charged particle beam is led through an evacuated tube to a target chamber containing a specimen of the substance whose nucleus is to be disintegrated. The charged particles emitted by the specimen are examined in a definite direction and the spectrum of the particles can be determined by a magnetic particle spectrometer. This apparatus consists essentially of a large magnet, since charged particles of different speeds may readily be distinguished from each other by the differing ways by which they are deflected in a magnetic field. Two types of magnetic particle spectrometer were on view at Aldermaston. In the first type, a definite angle only of discharge from the target can be viewed but the apparatus is very accurate. In the second type, many angles can be viewed but with less precision.

Another instrument in the experimental area is a large liquid scintillation counter which is being used as an efficient neutron detector set up to measure the number of neutrons emitted in the fusion of some heavy isotopes. Also on view at Aldermaston was a 6 MeV electrostatic generator which was manufactured by the High Voltage Corporation of America and cost approximately $600,000. A 3 MeV electrostatic generator and an 800 kV Cockcroft-Walton machine were available for inspection.

At the Press conference Sir William Penney (member



Multi-channel magnetic particle spectrograph. The coils surround the magnets while the slides above the magnets contain the nuclear emulsion plates for recording purposes

for Weapons Research, U.K.A.E.A.) detailed some of the other work being carried out by the A.W.R.E. Several hundred fuel elements containing 20 per cent by weight of plutonium, the remainder being aluminium, have been made for the experimental research reactor DIDO. Other work on metals has been concerned with investigations into the welding of beryllium. While primarily concerned with calculations for guided missiles, the computer centre at Aldermaston has also been employed on calculations required to determine the heat flows in graphite, neutron distribution around fuel elements, the calculation of lattice constants and stability of reactors. In two or three months' time the HERALD reactor will be running and this will give an intense beam of neutrons so that experiments can be carried out to determine how metals behave when bombarded by neutrons. Other work, in plasma physics, has been concerned with controlled thermonuclear reactions. Altogether, about 10 per cent of the research work carried out at Aldermaston is of basic theoretical character and has many applications apart from atomic weapons.

220 kV TRANSMISSION LINE FOR INDIA

FINANCED by Canadian Colombo Plan contributions, a 300-mile long 220 kV transmission line in India incorporates a newly formulated principle in design that resulted from a co-operative effort between the Madras State Electrical Authority and the Montreal Engineering Co., Ltd., who were assisted by the Electrical Conductor Division of the Aluminum Company of Canada, Ltd. (Alcan). The circuit, linking the new 48 and 168 MVA hydro-electric station of the Kundah development with Madras, is designed to carry a maximum load of 130 MW. The engineering responsibility is shared by the Madras State Electricity Authority and Montreal Engineering.

Once the basic electrical parameters of the transmission link were determined Alcan's Conductor Division was asked to co-operate in the technical details of the conductor. A conductor design and cost study was prepared to assist in the selection of the conductor size and design that would assure the most economic transmission. The result was the "Kundah" a.c.s.r., the characteristics of which are listed below with those of "Drake," which was the preliminary conductor selection.

	"Kundah"	"Drake"
Aluminium area—thous. cir. mils	795	795
Aluminium area—sq in	·6244	·6244
Aluminium area—Copper equivalent sq in	·493	·493
Stranding	42/7	26/7
Ultimate tensile strength—lb	21·050	30·900
Weight—lb/ft	·8580	1·091
Diameter—in	1·055	1·108

This specially designed a.c.s.r., due to the drastic reduction in steel reinforcement, costs about 15 per cent less than the standard 26/7 design in the same size.

To assure satisfactory operation of the conductor the following limits for the tension were recommended: Everyday temperature (90 deg F, 22·5 per cent ultimate tensile strength; loading of 12 lb/sq ft wind at 60 deg F, 40 per cent ultimate tensile strength. These tension values apply for the final condition of the conductor; that is, after the permanent set has occurred and the tapered armour rods and Stockbridge dampers have been installed on the line. Comparative sag data for "Kundah" and "Drake" for a "ruling span" section of 1,050ft are given below:

	"Kundah"	"Drake"
Loaded tension—lb	7,400	9,000
Loaded tension—per cent u.t.s.	35	29
Maximum sag at 120 deg F—ft	29·3	26

An evaluation of the weight of the suspension towers for both conductors indicated that the use of "Kundah" conductor would result in tower weights with equal or somewhat less weight per circuit mile than for "Drake." The angle and dead-end towers will be appreciably lighter for the conductor with the reduced maximum tension for these conditions. Thus, in addition to the very substantial saving in conductor cost, the selection of conductor with suitable characteristics results in a saving in the cost of the steel towers.

The general principle for the structural selection was straightforward. The conductor was considered not only as an electrical but also as a structural element of the transmission line. Analysing it, together with the tower, it was possible to determine the necessary steel reinforcement which would result in the lowest cost for the complete system. The great flexibility of a.c.s.r. makes it possible, almost without exception, to find a practical design very close to the theoretical optimum. This approach has been applied to river crossings and other special applications for considerable time. It is more fully described in *A.I.E.E. Transactions*, December, 1957, in a paper by P. G. Malburg entitled "Structural Selection of A.C.S.R. for Transmission Lines."

E.C.A. CONFERENCE

DISCUSSIONS AT EASTBOURNE

IN our 19th June issue we briefly reported the proceedings at the annual conference of the Electrical Contractors' Association and its allied organisations held at Eastbourne from 14th to 16th June, under the presidency of Mr. C. C. Hyams. Only one paper was presented, that by Mr. R. A. Joseph on "The Specialised Industrial Application and Installation: The Electrical Contractor's Opportunity in the Maintenance Field"; this was abstracted in the same issue. Mr. Joseph introduced his paper in a most lively and pleasing way and nine speakers contributed to the discussion.

Mr. R. A. Marryat, who opened, stressed the expense of maintenance and said that it was desirable to have spare motors in reserve so that defective machines could be quickly replaced and taken away for repair. To ensure continuity of supply in a factory there should be two main transformers each of which should be capable of carrying the essential load in the event of the failure of one of them. He also mentioned the value of the earth loop tester and properly graded fuses.

Mr. Joseph said that the cost of maintenance was small compared with the cost of loss of production through breakdowns. Too many people did not realise how much maintenance cost and contractors could show them the advantage of placing the work with them. Spare motors should be regularly tested to ensure that they were serviceable.

Mr. T. W. Blanshard criticised some of the slides shown by the author and then said that customers did not mind what they paid if they got good service. He questioned Mr. Joseph's remarks on the use of star-delta starters. He had not seen any stator windings damaged through direct starting.

Mr. Joseph replied that he saw at least one case a month in which heavy starting currents had set up a mechanical strain and damaged windings. He agreed that star-delta starters were unnecessary up to 25 h.p. but beyond that they should be used.

Mr. C. J. Veness approved the reference to the need for specialised maintenance plant, which most industrial establishments could not afford. He thought that plastic insulated cables were more easily jointed and reduced fire risk. Voltage surges on m.i.c.c. cables were sometimes the cause of damage. He doubted whether it was wise to skim commutators regularly and thus remove the protective skin which formed on them. The locking of brushes was a frequent cause of excessive sparking.

Mr. Joseph maintained that regular skimming was generally necessary although he agreed that if a protective skin was formed it should be allowed to remain. He said that a great deal was being done to overcome voltage surge in m.i.c.c. installations.

Mr. H. F. Truman agreed that electricity supply authorities appreciated dealing with contractors, who knew more about conditions of supply than factory owners. He deprecated the practice of industrial concerns employing electricians on maintenance work instead of placing the work with contractors. Contractors had done too little to "sell" themselves.

Mr. A. S. Redvers Pratt considered that not enough was made of the complexity of the equipment dealt with. The electricity supply authorities were greatly indebted to the contractors. Good maintenance staved off old age. Contractors had a duty to press their claims for first-class craftsmanship.

Mr. S. L. M. Barlow urged small contractors to get together to acquire maintenance equipment. He thought that modern p.v.c. cable was becoming more useful in increased (not very high) temperatures such as were experienced in the tropics. The mechanical side was a most important feature of maintenance.

Mr. Joseph said that the small contractor was the beginning and the centre of the scheme. A small contractor with premises near a works could provide a capable and efficient service, employing an outside repair service for work he could not undertake himself. Midland firms, at any rate, were recognising the value of maintenance by contractors. Any particular class of p.v.c. did not cover a very wide range of temperature.

Mr. M. R. H. Sadler mentioned the peculiar conditions prevailing in quarry installations. Quarry owners sometimes ordered motors and starters before placing their work with contractors and they were often unsuitable. Could not manufacturers do more to find out how their motors were to be used, in consultation with contractors?

Mr. J. Johnson deprecated the use of the term "preventive maintenance" as likely to be misunderstood by customers. Maintenance could not prevent some unexpected happenings although customers thought that it should. He preferred the term "electrical inspection service."

Mr. Joseph agreed that "preventive maintenance" was a bad term; his firm actually used the description "maintenance inspection service."

Mr. V. J. Stock (the new president) and Mr. C. J. Veness (vice-president); Mr. G. N. Walker (vice-president) and Mrs. Walker; Messrs. C. R. Waterhouse (vice-president) and J. W. Chadwick

Mr. C. King suggested the use of heat-sensitive devices in rotors as a form of protection against the heating-up of motors. He also agreed that some contractors while considering the current-carrying capacity of cables neglected voltage drop.

Mr. Joseph said that heat-sensitive devices could prevent burn-outs but would not be reliable; he did not know of any which was properly adjustable. Thermocouples were used in large machines. If a motor was single-phasing the overloads should trip out the starter. He did not think there was a case now for single-phasing prevention devices.

Debate and Final Meeting

On 16th June a debate was arranged on the motion "That Society is better served by independent business undertakings than by large amalgamations." Mr. J. Mortimer Hawkins proposed the motion and Mr. V. J. Stock opposed it. Those who took part in the debate were Messrs. A. F. Plummer, F. Ainscow, A. P. Johnson, R. H. M. Drake, W. J. Bird, F. Williams, A. S. Redvers Pratt, V. G. Gladwin, A. Apps and N. B. C. Gibson and Dr. H. H. Ballin.

At the concluding session Mr. Hyams introduced his successor Mr. V. J. Stock and invested him with the presidential badge. Mr. Stock said that for over thirty years the industry had given him an interesting life and a reasonable income and he thought it right that he should make some return in the shape of service to the Association.

Mr. Hyams thanked all who had helped to make the Conference a success, including the Eastbourne Corporation, for whom the Mayor replied. A vote of thanks to Mr. Hyams was moved by Sir Henry Self, chairman of the Electricity Council, who said that the electrical industry was a unity and there must be close collaboration between the sections. Mr. Hyams had done much to foster this co-operation.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Recruitment of Professional Electrical Engineers

I FULLY endorse the views so cogently expressed in your issue of 12th June by Mr. Stretch; in fact I would be inclined to go farther and venture the opinion which I have held for some time, that the I.E.E. is not only raising its examination standards prematurely but is also setting its sights too high. To my knowledge many young men are being discouraged from following Higher Certificate courses because they are proving too arduous a pathway to professional status with the result that the intake of men into the Institution from this source is being reduced to a trickle.

It would be helpful to have the views of the Electricity Boards on the effect of the new Regulations on recruitment to technical staff positions. In the annual report of the Electricity Council for the year ended March, 1958, reference was made to the numbers of employees who were given part-time day release to follow National Certificate and Diploma courses in engineering, but no indication was given of the numbers who were successful in achieving associate membership through this means. One is inclined to think that if figures could be made available they would prove to be rather startling.

The irony of the present situation is that many important engineering posts in the supply industry are at present filled by people who have never attained more than the Higher National Certificate standard and some not even that. Although one hesitates to mention it, it is believed that some have even risen to high office in the Institution. To make such assertions is no disparagement of their ability; on the contrary, they are shining examples of the fact that a great deal more than mere success in examinations is necessary for progress as engineers. I would be the last to belittle the importance of young engineers having sound tuition in fundamental principles and a good foundation of theoretical knowledge, but a proper sense of balance must be maintained. As Mr. Stretch states, too much emphasis is being placed on theoretical qualifications.

It is more important that men responsible for the operation of large modern generating stations or distribution systems should be able to handle men and deal with the practical problems which arise from day to day than to carry out the abstruse calculations which may be necessary in design and research departments.

By insisting on too high a standard of educational requirements the I.E.E. is making it almost impossible for manual grades who are ambitious to progress to acquire professional status. Industry should be able to recruit professional engineers from the lower ranks as well as from the universities as has been done in the past, otherwise the country may be deprived of material which, given reasonable opportunities, would make good engineers. If a man starting rather late in life feels it is almost impossible for him to satisfy the new Regulations of the I.E.E., although quite capable of obtaining the Higher National Certificate with the necessary endorsements, he will be discouraged from making any attempt at all.

One cannot help contrasting the hurdles which a young man who has not been to a university or who starts on an engineering career a little late in life has to surmount before he attains professional status with those which would confront him if he decided upon some other profession such as law or accountancy.

These criticisms would not arise if the standard of educational requirements were merely for admission to a scientific society (which of course the I.E.E. is) but corporate membership is now becoming a condition of appointment to many engineering posts in industry. Thus the introduction of Regulations which impose higher standards prematurely and before educational institutions and industry have had time to adapt themselves may act as a serious bottle-neck in the recruitment of engineers.

I believe that Mr. Stretch's article will be fully endorsed by the majority of engineers occupying the higher executive posts in the supply industry.

Bournemouth. J. W. THOMAS.

WITH reference to the article by Mr. K. L. Stretch on "Recruitment of Professional Electrical Engineers" in your issue of 12th June, I should like to support his plea that the Institution should not place so much importance on theoretical knowledge obtained through a prescribed pattern. The idea that an engineer who has obtained his

theoretical knowledge through a full-time course is better equipped than one who has gone through a part-time day or evening course is pure conjecture, and I know of no reliable experiments which have been carried out to prove which is the better form of engineering education.

No decision made by a scientific body regarding preferred forms of education should be arrived at unless scientific methods have first been employed to come to this conclusion. I know of cases where students have been brilliant in their O.N.C. course and as a result have been sponsored by their firms to undertake a Dip. Tech. course, but were unable to follow the more rapid form of acquiring knowledge.

There is at present no evidence to support the Institution's idea that very few engineers will qualify via H.N.C. courses and this evidence will not be forthcoming until 1961, by which date a reasonable number of post-H.N.C. students will be coming forward for examinations.

I would agree that it is undesirable for the Institution's professional standards to be lowered and feel that the Part III examinations will, with time, become a very good instrument for assessing the ability of candidates. However, the insistence on two specialist subjects in addition to the comprehensive subject of advanced electrical engineering seems quite unreasonable. An engineer who at an early age specialises in two subjects is not necessarily a good engineer.

I would suggest that a far better arrangement of the examination would be two papers on advanced electrical engineering, together with one specialist paper. This would not in any way lower the standard, but ensure that advanced electrical engineering was adequately dealt with by colleges, and fully covered by the examination. In addition, colleges would find it far easier to obtain specialist lecturers for one subject, rather than for two. It might even be advisable to incorporate in advanced electrical engineering some element of engineering management, so that a qualified engineer would have some claim to a knowledge outside of the orbit of the electron.

Wimbledon, S.W.19. R. A. LOCKE,
Head of Electrical Engineering Department,
Wimbledon Technical College.

Electric Cars and the Channel Tunnel

IT is stated by Mr. Leo d'Erlanger, chairman of the Channel Tunnel Company (*Daily Telegraph*, 9th June) that: "Apart from the problem of ventilation and space to cope with breakdowns, many people would find driving 30 miles underground an intolerable strain. . . . As far more cars could be taken through by rail than under their own power, the latter method is simply not an economic proposition under present conditions." Electric cars could pick up power as they travelled and at the same time automatic steering could take over and automatic spacing between cars could be maintained, thus saving the annoying congestion of on and off loading at each end of the tunnel.

Stelling, Nr. Canterbury. F. L. R. BROWN
(Traction Electric, Ltd.)

Kitchen Planning

I WAS very glad to see in your 12th June issue your reference to the ever growing importance of kitchen planning. For some time I have been trying to bring home to the industry and to architects and builders the importance of the fact that in most modern homes kitchens are too small. They have been designed with no appreciation of the need to provide space to accommodate the growing number of labour-saving appliances the housewives of today demand. One so frequently hears the complaint, "I should like to have that refrigerator [washing machine, dish washer or dryer] but there is no room in my kitchen."

A year ago I wrote to all the architectural and builders' journals on the subject. Only one took the question up. The *Daily Mail* was more helpful and suggested to the builders of its Ideal Home Exhibition houses that the trend should be towards larger kitchens to give future house purchasers more convenient accommodation.

The time is coming when the sale of many domestic electrical appliances will be restricted by kitchen size and although it may seem an oblique approach to people in our industry, it is time that E.D.A., the E.A.W., Area Boards and manufacturers did something about it by making a concentrated and sustained approach to bring the importance of the question home to the building trade.

Brighton. R. E. GAMLEN.

I.E.E. Special General Meeting

AT a special general meeting of corporate members of the Institution of Electrical Engineers on 25th June, two resolutions of the Council proposing increases in entrance fees of 50 per cent and in annual subscriptions of approximately 30 per cent were offered for confirmation. After a discussion contributed to by ten speakers, the first resolution regarding entrance fees was confirmed by show of hands, 102 in favour and 81 against (there were 198 members at the meeting). This vote had, however, been preceded by a demand by three members for a poll, which those members subsequently, with permission, withdrew.

On the second resolution, concerning increases in annual subscriptions, the same three members demanded a poll, and the President, as chairman of the meeting, directed, in accordance with Bye-Law 86, that the poll which had been demanded be taken at the Institution building on 9th July. The President added for the information of members that all corporate members entitled to vote could record their votes, and that those who held proxies would be entitled to vote in respect of those proxies, but that no new proxies might be lodged. The result of the poll was 423 in favour (335 personal and 88 proxy) and 739 against (349 personal and 390 proxy).

The Council of the Institution has since issued a notice of a special general meeting of corporate members to be held at the Institution of Civil Engineers on Tuesday, 18th August, at 5.30 p.m., for the purpose of considering and, if thought fit, confirming a resolution proposing revised increases in annual subscriptions.

Radiation Protection Measures

THE 17 countries of the Organisation for European Economic Co-operation have agreed on measures towards safeguarding their populations from the dangers of nuclear radiations. At a meeting in Paris, the Council adopted a decision requiring member countries to ensure adequate health protection for all persons who might be exposed either occupationally or otherwise to ionising radiations. Appropriate safeguard measures to meet emergencies or accidents involving these radiations must also be taken. Countries are called upon to report to the European Nuclear Energy Agency by 15th November this year on their legal and administrative measures in this field, so that the Agency can make a comprehensive survey by the end of the year. The measures are based on the recently revised recommendations of the International Commission on Radiological Protection, applying to occupational exposure in "controlled areas," which contain sources of ionising radiation, to exposure in "surveyed areas" in the vicinity of controlled areas, and to exposure in any other areas.

NEWS RECORD SUPPLEMENT

Summary of events in the electrical world during the seven-week period of the printing stoppage during which the *Electrical Review* has unavoidably had to suspend publication

Japanese Nuclear Power Contract

A Reuter message from Tokyo reports that the Japan Atomic Power Generating Co. states that the formal signing of the contract for the import of a Calder Hall-type nuclear generator has been postponed until probably the latter part of next month. Signing of the contract between the company and the General Electric-Simon-Carves nuclear power group, was originally expected to take place this month, the company said. The Government's Atomic Energy Commission, however, after its public hearing held on 31st July on the safety of the Calder Hall-type reactor, decided to submit the question to a symposium of the Japan Science Conference, an organisation of leading Japanese scientists, to be held on 22nd August. This has prolonged the procedure required before the formal approval of the Japanese Government could be given.

Wages in the Contracting Industry

On 19th June agreement was reached between the National Federated Electrical Association and the Electrical Trades Union for an increase in wages in the electrical contracting industry as from 20th July. The London journeyman's rate will rise from 5s 2½d to 5s 3½d an hour and the provincial rate from 4s 9½d to 4s 11d. Adult mates and apprentices will receive proportionate increases.

Hours and Pay Claims

At a meeting of the Confederation of Shipbuilding and Engineering Unions at York on 9th July, it was decided to press immediately for the 40-hour week and a substantial wage increase.

Union leaders of the 120,000 workers in the electricity supply industry decided on 16th July to submit a claim for a 40-hour week. The claim will take its place with the two existing demands for a third week's holiday with pay, and improvements in the industry's sick pay scheme.

Domestic Cooker Agreement Terminated

The Restrictive Practices Court was told at the end of June that the agreement of the Associated Manufacturers of Domestic Electric Cookers was terminated by resolution with effect from 31st May, 1959. The activities of the Association have ceased.

200 MW Sets for Australia

The English Electric Co., Ltd., has been awarded a contract to build Australia's first 200 MW steam turbo-alternators. In a total contract valued at £A4¾ million negotiated by the company's Australian subsidiary, the English Electric Co. of Australia Pty., Ltd., with the Electricity Supply Commission of New South Wales, the parent company will supply two 200 MW turbo-alternators valued at some £3 million sterling. The remainder of the order, consisting of condensing and feed heating plant, will be manufactured in Australia to English Electric designs. The turbo-alternators will be installed at a new power station at Vales Point, 70 miles north of Sydney on the southern shore of Lake Macquarie. The station will be the largest in the southern hemisphere, with a capacity of 1,500 MW.

Henley's Woolwich Factory to Close

W. T. Henley's Telegraph Works Co., Ltd., is to close its North Woolwich factory which produces principally rubber insulated cables. The process will be gradual and the slowing down may extend over two years. The factory is the oldest and smallest of the company's three factories and the decision to close it is part of a scheme of rationalisation. Production of special types of rubber cables will be mostly transferred to the Birtley (Durham) factory.

British Motors for America

An order for 500 light industrial/domestic motors of a new type specially developed for the North American market has been placed through the Newark, U.S.A., eastern region sales office of Newman Industries, Ltd., Bristol. The motors, which are of the totally enclosed, fan-cooled ¼ to 2 h.p. type, are to be used for driving fans in car washery plants. Another order for 300 pump motors has been received from the Peerless Pump Division of the Food, Machinery and Chemical Corporation, Los Angeles.

Reyrolle New Zealand Company

To facilitate the handling of their New Zealand business, A. Reyrolle & Co., Ltd., have registered a new company in New Zealand to be known as A. Reyrolle & Co. (N.Z.), Ltd., to handle the whole of their switchgear business in that country. The directors of the new company will be Mr. W. A. Simpson, who has represented Reyrolle's in New Zealand since 1933, and Mr. W. G. Martin, overseas manager. Allum Electric Co., and Giles & Elliott, Ltd., will continue to handle the plug and socket and low-voltage fuse business as before.

Meter Reading from Outside

The Eastern Electricity Board is pioneering a meter reading window through which readings can be taken outside a house. The window, about eight inches square, is best placed in the kitchen and the cost in the case of new houses is said to be small. Windows of this kind have been provided experimentally in houses at Leigh, Rayleigh, Billericay and Hockley. Mr. R. H. M. Barkham, chief commercial officer of the Board, said that if the idea caught on it would mean a substantial saving in money to all Electricity Boards.

Staff Compensation Regulations

The Electricity (Staff Compensation) Regulations, 1959, make provision for the payment of compensation by the Electricity Council to former employees of the Central Electricity Authority or an Area Board who have suffered loss in consequence of the operation of the Electricity Act, 1957. The compensation is payable in (a) resettlement compensation for loss of employment; (b) long-term compensation for loss of employment, loss or diminution of emoluments or pension rights, or worsening of position; and (c) compensation for diminution of pension rights of persons who cease to be entitled to long-term compensation.

Equipment for Rumanian Tyre Factory

Rustyfa, Ltd., the British consortium, has secured a contract for the design and supply of machinery and equipment for a large tyre factory in Rumania. The value of the contract is over £7·5 million. The member companies of Rustyfa are David Bridge & Co., Ltd., Crompton Parkinson, Ltd., Lancashire Dynamo Holdings, Ltd., Mather & Platt, Ltd., Francis Shaw & Co., Ltd., and Simon Handling Engineers, Ltd.

Ekco Electronics in Italy

Ekco Electronics, Ltd., announces the formation of a new company in Italy, to be known as Ekco Nucleare Italiana, s.r.l., in association with Ing. Silvio Garrone, s.r.l. The company, which will deal with the Italian market, will facilitate nuclear instrumentation in the fields of atomic reactors, industrial instrumentation and the sale of nucleonic and research development instruments. Ing. Silvio Garrone is managing director.

Television Equipment for Hunterston

The first part of a large order for closed circuit television equipment to be supplied to Hunterston nuclear power station (South of Scotland Electricity Board) has been placed with Pye, Ltd. The equipment is to be used for observation inside the reactor and for the monitoring of various other services. The contract is valued at £50,000.

Transatlantic Film Transmission

A system developed by the B.B.C. Engineering Division for transmitting, in either direction, film sequences of up to one minute's duration over a circuit of the transatlantic telephone cable normally used for sound was announced by the

B.B.C. on 17th June. Film sequences can be reproduced in a much shorter time than is required to fly film across the Atlantic; for example, half-minute film sequences can be transmitted in less than 50 minutes and can be shown on television some 20 minutes later.

American Order Lost

The Florida Power & Light Co. has rejected tenders by the English Electric Co. and the Brown Boveri Co. (Switzerland) for two 200 MW turbo-generators. It is stated that the reason is that the company has decided to buy 300 MW sets and the two foreign companies could not build these within the specified time.

Import Duty Amendments

The Treasury has made the Import Duties (General) (No. 7) Order, 1959, which amends certain of the rates of customs duty in the United Kingdom Customs Tariff. The Order has been made under the Import Duties Act, 1958, and came into operation on 20th July. On certain goods, including electric hair dryers, the present ad valorem duty is reduced.

Iron Ore Plant

A contract valued at over £1¼ million has been received by the General Electric Co., Ltd., as main contractors, for a complete iron ore preparation plant at the Redbourn Works of Richard Thomas & Baldwins, Ltd., at Scunthorpe. The plant is designed for an initial throughput capacity of 1¼ million tons of iron ore per annum.

Yachting Fatality

An inquest was held at Pershore, Worcestershire, on 13th July, on Ian Guthrie (20), who was drowned in the River Avon on 28th June after the mast of the yacht in which he was sailing with three friends struck a high-voltage line. Mr. R. Mallett (Midlands Electricity Board) said that at several places lines over the river had been raised to 45ft in 1954 but at this point the height was 40ft 6in. The owners of the boat had been informed of this. A verdict of "Death by misadventure" was returned, the jury adding a rider that all boat owners should make sure that the hirers were fully aware of the dangers arising from cables across the river and recommending that warning notices should be displayed on the river banks.

Railway Power Station Closed

With a farewell tribute to generating plant that has provided power for the Mersey and Wirral electric railway system since 1903, British Railways on 25th June closed their Shore Road, Birkenhead, power station. Energy will in future be supplied from the national grid through a newly installed substation.

Welsh Power Station Contract

A contract valued at over £1,000,000 has been awarded to Taylor Woodrow Construction, Ltd., by the Central Electricity Generating Board for a hydro-electric project at Cwm Rheidol, near Aberystwyth. The consulting engineers are Freeman, Fox & Partners in association with James Williamson & Partners.

The work will take two years to complete and involves the construction of a 700ft long concrete gravity dam, the maximum height of which will be 40ft; the driving of a concrete-lined tunnel, 2,200ft long with a finished diameter of 9ft 6in; and the sinking of a 25ft diameter concrete-lined surge shaft to a depth of 150ft, and a 10ft diameter pressure shaft to a depth of a further 510ft. The contract also includes the construction of a power station in which two 18 MW turbo-alternators will be installed. Ancillary works entail the construction of a fish ladder.

This contract is the fourth and last of the major civil engineering contracts of the Rheidol hydro-electric project, the construction of which has been in progress for two years.

Nuclear Propulsion of Ships

The English Electric Co., Ltd., has announced the completion of a preliminary survey of possible reactor systems for the economic nuclear propulsion of merchant ships. This study project has been carried out by a group of English Electric reactor engineers advised by marine engineers from Vickers-Armstrong, Ltd.

E.I.B.A. Income Increased

The voluntary income of the Electrical Industries Benevolent Association rose in 1958 by £7,000 to a record total of over £75,000. Over half the increase came from a rise in personal contributions as a result of campaigns among employees of the supply industry. Although 69 more cases were helped than in the previous year, the Association had a surplus. One reason was that more people are going to the Association with non-financial problems.

This expansion of the E.I.B.A.'s welfare activities was referred to by Dr. T. E. Allibone, the retiring president, when he presented the report and accounts for 1958 to the annual meeting held on 1st July. He said that no other benevolent fund in the country took such a broad view of its responsibilities.

At the subsequent Court meeting Sir Leslie Gamage was elected president for the year 1959/60 and at the meeting of the Court Mr. C. R. King was re-elected chairman.

Electric Locomotives for Poland

A contract has been signed in Warsaw between the Polish Government Agency, Elektrim, and a Contractors' Committee, British Insulated Callender's Construction Co., Ltd., the English Electric Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd., for the supply of twenty electric locomotives and overhead line equipment from Great Britain, together with a licence to build more in Poland, for 30 million zlotys (£2·7 million).

Dungeness Nuclear Station Approved

It was announced in the House of Commons on 13th July that the Minister of Power had decided to give his consent to the proposal of the Central Electricity Generating Board to construct a 500-550 MW nuclear power station at Dungeness, Kent, and to certain parts of the routes proposed for the associated transmission lines. A decision on other parts of the transmission lines had been deferred pending the examination of a possible alternative route. At public inquiries objections to the use of the site were put forward on the grounds that the area was of unusual scientific interest. A site at Redham Mead, on the Thames Estuary, was suggested but the inspectors concluded that this could not be considered as a practicable alternative to Dungeness.

Lord Mills has stated that he had decided to approve the route proposed by the C.E.G.B. from Dungeness to Lydd substation, from Lydd substation to a point near Old Romney, and to the "green route" from this point to a point near Stowting. He proposed to invite the Board to consider alternative routes from Stowting to Nackington. From Nackington to Canterbury the route applied for was not the subject of objections and he was giving consent for this part forthwith in order to allow construction to proceed. In addition the Minister of Housing and Local Government had allowed the Board's appeal on an application for planning permission to establish a 275 kV substation at Lydd.

Overhead Line Action

In the Chancery Division on 13th July Mr. Justice Lloyd-Jacob gave a reserved judgment in favour of the Central Electricity Board in an action against a Leicestershire farmer, Mr. F. Jennaway, claiming that the Board was entitled to erect a 275 kV line across his land. A similar action was brought against a neighbouring farmer, Mr. W. T. Clarke, who submitted to judgment. His lordship said that the evidence given by officials of the Board failed to establish that the Board was entitled to any damages against the farmers for increased costs of constructing the line as a result of the delay caused by the objections.

A counterclaim by Mr. Jennaway that the Minister's consent to the construction of the line was void and did not include the erection of pylons, was dismissed with costs, and he was ordered to pay the costs of the action.

Better Export Credit Facilities

The Federation of British Industries has recommended in a memorandum to the Treasury and the Board of Trade that existing credit facilities for British exporters of heavy capital goods should be supplemented by long-term loan facilities for a term of 10 to 15 years to the foreign customer appropriately guaranteed by the British Government. This would enable British firms to offer credit facilities more comparable with the 15 to 20 year credits provided by the development loans of the U.S. Export-Import Bank.

Heating and Ventilating Research

The Heating and Ventilating Research Association was registered on 15th July as a company limited by guarantee without share capital, with an unlimited number of members, each liable for £5 in the event of winding up. The word "Limited" is omitted from the title by licence of the Board of Trade. Its objects are to promote research and other scientific work in connection with the heating, hot water supply, ventilation and air conditioning trade and industry, etc. The management is vested in a Council, the first members of which are not named. The British Coal Utilisation Research Association and the Institution of Heating and Ventilating Engineers may be invited to nominate a member of the Council. The solicitors are Bulcraig & Davis, Amberley House, Norfolk Street, London, W.C.2.

Canadian National Exhibition

The Board of Trade is again organising a display of British consumer products for the Canadian National Exhibition being held in Toronto from 26th August to 12th September. The Council of Industrial Design has selected more than 250 samples of well-designed British consumer products to go on the stand being provided

by the Board of Trade. They include heating and kitchen equipment, lighting equipment and radio sets.

New Moffats Company

Moffats, Ltd., is again trading directly in the United Kingdom. For the past few years the import and distribution of its products within the limits of the token import scheme has been conducted by James Earthrowl & Co., Ltd. Liberalisation of trade in domestic appliances between Canada and the United Kingdom has led Moffats to take over, with effect from 1st July last, complete distribution activities in the United Kingdom, as a prelude to manufacture again in this country. A new company, Moffats, Ltd., has been formed and Mr. H. W. Earthrowl has been appointed managing director. The company will continue to operate for the time being from 1, Newman Street, London, W.1. Substantial price reductions are announced with effect from 1st July.

Telecommunication Equipment Order

Progress on the first link in the £88 million Commonwealth telecommunication cable has reached a further stage with the placing of an order in Britain by the Canadian Overseas Telecommunication Corporation, Montreal, for terminal equipment at the Canadian end. The $2½ million contract for the manufacture and establishment of a repeater submarine cable telephone system between Corner Brook (Newfoundland) and Grosses Roches (Quebec) was placed in September last year with Submarine Cables, Ltd., owned jointly by Siemens Edison Swan, Ltd., and the Telegraph Construction & Maintenance Co., Ltd. Over $500,000 worth of terminal equipment now to be supplied by Siemens Edison Swan, Ltd., will be installed at Corner Brook and Grosses Roches to serve this 400 mile section: the Corner Brook equipment will additionally terminate the Canadian side of the transatlantic section.

Baghdad Contract

Brookhirst Igranic, Ltd., a Metal Industries subsidiary, has been awarded a £50,000 contract for control gear for the Baghdad main drainage scheme. The contract was placed by the Pulsometer Engineering Co., Ltd., which is supplying the pumps.

Transformers for New Zealand

A further order of approximately £30,000 has been received by the Gresham Transformer Group, Twickenham Road, Hanworth, Middlesex, for the supply of a number of power transformers to public service authorities in New Zealand.

Domestic Appliance Sales

The monthly returns of the Electricity Council for April and May show that sales of electrical appliances by Area Boards have remained at a high level, only wash boilers being in reduced demand. The sharpest increase has been in sales of refrigerators. Last year these reached a peak of 12,845 in May while in the same month this year no fewer than 30,556 were sold.

Appliance	April		May		Twelve months ended 31st May	
	Total	Inc. or dec. %	Total	Inc. or dec. %	Total	Inc. or dec. %
Cookers	27,790	+ 55·7	27,947	+ 44·6	304,095	+33·0
Water heaters:						
Immersion	17,734	+ 19·7	26,551	+ 7·5	171,953	+11·7
Storage	5,153	+ 41·9	5,155	+ 14·2	54,224	+26·6
Wash boilers	5,856	− 10·7	5,453	− 22·8	75,643	− 4·9
Washing machines	15,553	+169·0	13,636	+ 71·9	141,814	+93·7
Refrigerators	15,747	+218·6	30,556	+137·9	111,202	+84·7

New Aluminium Company

Imperial Chemical Industries, Ltd., and the Aluminum Co. of America are jointly forming a company, the Imperial Aluminium Co., for the purpose of manufacturing wrought aluminium products in the United Kingdom. The I.C.I. will hold 51 per cent of the capital of about £10 million and will appoint three of the five directors.

Catalogue in Arabic

The General Electric Co., Ltd., has produced a 300 page catalogue of installation materials and certain other products such as street lighting fittings and domestic appliances which is printed entirely in Arabic. Since the small electrical contractors for whom it is primarily intended are not highly trained an introductory section on the basic principles of electricity is included and there are notes on the testing of completed installations and on the selection of f.h.p. motors. The catalogue, which is handsomely bound and printed on tough paper, has been sent to the heads of Governments and educational bodies in the Arabic speaking world and to the company's agents for distribution to contractors, dealers, etc.

Kuwait International Airport

Messrs. Frederick S. Snow & Partners, who were the consulting engineers for the design of Gatwick Airport, have now received approval for their preliminary proposals for the design of a new international airport at Kuwait. Work is now proceeding on the detailed design. This new airport, which is to be built on a desert site a few miles south of Kuwait Town, will be a Class A.1 airport capable of handling the largest civil jet aircraft now coming into use.

Thorn-Luminator Agreement

Thorn Electrical Industries, Ltd., announces that as a result of an agreement between its subsidiary, Atlas Lighting, Ltd., and Luminator, Incorporated, of America, it has acquired a licence for the manufacture and distribution of Luminator bus, ship, aircraft and train lighting fittings in this country. These products will be handled by the Components and Connector Division of Thorn Electrical Industries, Ltd.

Norwegian Reactor Critical

The boiling heavy water reactor of the Norwegian Institute for Atomenergi at Halden, 120 km south of Oslo, was successfully operated for the first time on 29th June. The reactor, which is the first of its kind in the world, is to be used for a joint programme of research and experiment organised by the O.E.E.C. European Nuclear Energy Agency. The natural uranium fuel was supplied by the United Kingdom Atomic Energy Authority and the total cost of the plant, including the heavy water and the first uranium fuel load, was $3·5 million. During the next six months the reactor will be operated at low power levels to enable fundamental reactor physics experiments to be performed. After this, the power level will be increased gradually up to the design power of 10 MW thermal. The plant will be officially inaugurated on 10th October.

New "Popular Pack"

Atlas Lighting, Ltd., announced this week the production of their millionth "Popular Pack" fluorescent lighting equipment. At the same meeting they introduced a new "Super Slim" pack which is to replace the older type, with a substantial reduction in prices.

Beryllium Production

The Imperial Smelting Corporation, the United Kingdom subsidiary of the Consolidated Zinc Corporation and the Beryllium Corporation of Reading, Pa., U.S.A., announces the formation, subject to Exchange Control consent, of a new, equally-owned British company, Consolidated Beryllium, Ltd., which Imperial Smelting will manage. The new company will produce nuclear grade beryllium metal and beryllium-copper master alloy as raw materials for sale to fabricators both in the United Kingdom and in Europe. It will operate the beryllium metal plant at Avonmouth due to start production later this year. The new company will also commence immediately the erection of a beryllium-copper master alloy plant at Avonmouth to supply an already established market in the United Kingdom.

Equipment for Ferries

The General Electric Co., Ltd., has received an order valued at approximately £70,000 to supply the diesel-electric machinery for the two Torpoint chain ferries being constructed by John I. Thornycroft & Co., Ltd., Southampton, for the Cornwall County Council. The equipment for each ferry consists of three diesel generating sets, made up of a National NM 8 diesel engine driving a 112 kW main generator in tandem with a 35 kW auxiliary generator.

Domestic Refrigeration Development Committee

The secretarial and administrative arrangements for the Domestic Refrigeration Development Committee ("Dordec") will in future be undertaken by C. S. Services, Ltd., 5, Carlos Place, London, W.1. The members of Dordec are:—A.E.I.-Hotpoint, Ltd., Astral Equipment, Ltd., Electrolux, Ltd., English Electric Co., Ltd., Frigidaire Division of General Motors, Ltd., General Electric Co., Ltd., Kelvinator, Ltd., and Pressed Steel Co., Ltd.

Transatlantic Telephone Cable

The laying of the deep sea section of the first telephone cable system to link North America with the mainland of Europe was completed on 12th July. The final splice of the transatlantic section of the twin cable system between Penmarch in France and Clarenville, Newfoundland, was laid by the British cableship "Monarch" ten miles off the French coast. Only the 326-mile single cable link

between Newfoundland and Nova Scotia remains to be laid. The system will be in operation this autumn. It will be recalled that c.s. "Ocean Layer" had almost completed laying a 940-mile section of deep sea cable when fire broke out on board causing the vessel to be abandoned.

Scottish Electrical Training Scheme

At the recent annual meeting of the Scottish Electrical Training Scheme, Ltd., Mr. K. W. Atchley (chairman), in submitting his report for 1958, referred with regret to the decision of Mr. William Fraser, Junr., to resign as governing director, and welcomed in his place as representative of Scottish Cables, Ltd., Mr. J. S. Hastie. Mr. L. R. Price, of Honeywell Controls, Ltd., was also resigning upon taking up residence in London; in his place as governing director the company had nominated Mr. C. H. Offord. During 1958 the first three graduates entered their final "sponsored" year's training with member organisations. Eight graduates joined the scheme, with two others taking a fourth honours year at university.

Hawker Siddeley-Verity Deal

The Brush Electrical Engineering Co., Ltd., a member of the Hawker Siddeley Group, is purchasing the rotating machine section of Veritys, Ltd., which recently went into voluntary liquidation. Manufacture of rotating machines is continuing for the present at Birmingham, but it is intended that the Verity rotating machine range shall be manufactured in future at the Brush Works at Loughborough.

Transformers for South Africa

An order has been placed with Metropolitan-Vickers South Africa (Pty.), Ltd., by the Electricity Supply Commission of South Africa for two 100 MVA autotransformers for Komati power station. The transformers will be manufactured by the A.E.I. Transformer Division.

New Organisation in Exeter District

The South Western Electricity Board's Exeter District now includes the former East Devon District and those parts of the Exe Valley District which are in Devon. The district manager is Mr. F. Richardson, the deputy manager is Mr. R. H. Upton, and the district office is at 3, Bedford Street, Exeter. Branch managers of the new District are: Exmouth, Mr. J. S. MacDiarmid; Sidmouth, Mr. P. C. Tracey; Honiton, Mr. W. Badham; Tiverton, Mr. R. W. Colwill; and Crediton, Mr. E. J. H. Marshall.

Plessey Nucleonics Works Extension

An extension to the Northampton factory of Plessey Nucleonics, Ltd., was opened on 21st July by Sir John Cockcroft. On arrival at the factory, Sir John was welcomed by Mr. A. G. Clark, chairman of the Plessey Co., Ltd., Dr. Denis Taylor, a director and general manager of Plessey Nucleonics, and other Plessey group directors.

W. Canning & Co. in Australia

W. Canning & Co., Ltd., are extending their interests in Australia by acquiring a holding in an Australian company, Lawrence Smith & Co. (Pty.), Ltd., of Sydney, with whom they have been closely associated for over fifty years. The name of the Australian company is to be changed to Lawrence Smith & Canning (Pty.), Ltd., with head office and warehouses in Sydney, and a branch in Melbourne.

New Bulawayo Tyre Factory

The Prime Minister of the Federation of Rhodesia and Nyasaland, Sir Roy Welensky, officially opened the new Bulawayo factory of Dunlop Rhodesia, Ltd., the Dunlop Co.'s tyre producing plant, on 25th July. The Electric Construction Co., Ltd., was entrusted with the overall responsibility for the design, manufacture and installation of the complete electrical equipment for this new factory, including substation equipment, motors, switchgear and lighting. Cables, lighting, sub-distribution systems and complete installation formed a sub-contract placed by the E.C.C. with its South African associates, Hubert Davies & Co., Ltd., Johannesburg.

Hoover Extensions in Wales

Hoover, Ltd., is to spend over £2,000,000 in building and equipping a 110,000 sq ft extension to Hoover (Washing Machines), Ltd., at Pentrebach, near Merthyr Tydfil, Wales; the scheme is due for completion by May next year. This is in addition to the capital cost of the existing 283,000 sq ft building at Pentrebach, which Hoover, Ltd., recently bought from the Board of Trade.

Leamington Spa Illuminations

As a tribute to the Illuminating Engineering Society, in its jubilee year, Mr. L. E. Gibbs, chairman of the Birmingham Centre, and members of his Committee were invited to attend the official opening of the illuminations in Jephson Gardens, Royal Leamington Spa, on 27th July, at which the Society's jubilee year symbol figures prominently amongst the illuminated features.

Bylock American Agreement

Bylock Electric, Ltd., announces that an agreement with the Lewyt Corporation, of New York, has been completed. It is anticipated that production under various licences of appliances at present manufactured in America will commence early in 1960.

B.E.A.M.A. Publicity Conference

The fourth annual B.E.A.M.A. Publicity Conference will be held at the Connaught Rooms on 3rd and 4th November. The programme will follow the pattern of last year's.

Increased Post Office Expenditure

Estimates of Post Office expenditure for 1959-60, at £94·5 million, showed a reduction for the third year in succession, a fact which created a great deal of consternation in the telephone manufacturing industry. It was announced last week, however, that the Government had decided to allow a balance of £1·2 million from the year 1958-59 to be carried over into the current year. Also the figure of £91·5 million proposed for 1960-61 is to be raised to £97·5 million. While the allocation of the increased expenditure has not been announced it has been hinted that the bulk of it will go to the telephone service.

More Power for Glasgow

A major scheme to augment supplies of electricity to the central area of Glasgow has been prepared by the South of Scotland Electricity Board. The 275 kV line to be constructed between Windyhill and Kincardine will be deviated into Lambhill where a 275 kV switching station will be established. From this point a double circuit 275 kV underground cable will be laid to West George Street; the capacity of each cable will be 300 MW.

Higher Charges in North Scotland

The North of Scotland Hydro-Electric Board has increased its tariffs by 5 per cent as from the first meter readings after 1st July. Off-peak charges are not affected.

Association of Electrical Machinery Trades

The annual general meeting of the Association of Electrical Machinery Trades was held at Bailey's Hotel, Gloucester Road, London, S.W.7, on 6th July. Before the meeting a luncheon was held at which the retiring chairman, Mr. C. G. Aldridge, presided. At the meeting Mr. Aldridge, in submitting the report of the Council, said that whilst the Association had been able to maintain its strength, in numbers, it was essential that the membership should be expanded. He referred to the formation during the year of an Area Committee covering the Midlands and stated that a similar Committee would be formed shortly in the South. Following the adoption of the report, Mr. N. G. Saunders (Western Dynamo & Motor Co.) was elected chairman for the ensuing year, and Mr. E. W. Clark (C.S.S. Electrical Co., Ltd.), was elected vice-chairman and treasurer.

G.E.C. Loan

The General Electric Co., Ltd., is making an issue of £8 million loan stock to provide funds for the repayment of an £8 million issue which falls due for repayment on 30th September. The new issue will be of unsecured loan stock at 6 per cent repayable 1979-84 at par. Holders of the maturing loan have agreed to apply for £4 million of the new stock and the £4 million balance will be offered to preference and ordinary stockholders and unsecured loan stockholders of the company.

Batti-Wallahs' Society

The speaker at the June luncheon of the Batti-Wallahs' Society was Sir Christopher Hinton, chairman of the Central Electricity Generating Board, who in a thoughtful address dealt with the problem of electricity supply and amenities. At the July luncheon of the Society, Mr. D. Hughes of the Whitechapel Bell Foundry, whose company has been making bells for four centuries, spoke of the evolution of bell-making. Mr. J. Temple Hazell, the president of the Society, was in the chair on both occasions. The next luncheon will be on Thursday, 24th September.

Price Reductions

Siemens Edison Swan, Ltd., has reduced the prices of a wide range of Ediswan-Mazda valves as used in domestic receivers. Considerable reductions have also been made in the retail price of a number of Ediswan-Mazda transistors, as from 1st July.

A reduction in the prices of Ekco "Warm-Glow" electric blankets is announced by E. K. Cole, Ltd., effective from 1st August. The only models unaffected are the "Juno" and "Sylvia," the prices of which remain unchanged.

Fibreglass, Ltd., has announced price reductions of 2½ per cent to 15 per cent on all continuous glass yarns as from 1st July.

Bulpitt & Sons, Ltd., have reduced the prices of their 3 kW immersion heaters. There is no reduction in the thermostat prices.

Elcontrol, Ltd., has reduced the prices of certain control units and all of the probe fittings in its electronic level control range. The reduction, where it applies, consists of the withdrawal or diminution of the general 10 per cent advance that was imposed at the end of 1957.

Price reductions of frozen food display cabinets and a wide range of other commercial refrigeration products are announced by the Frigidaire Division of General Motors, Ltd.

The General Electric Co., Ltd., announces that as from 10th August "Osram" 8ft 125 W fluorescent tubes have been reduced from 20s to 17s 6d, while the reflector type in this rating is now priced at 20s (former price 22s). Its 12in 8 W and 9in 6 W tubes are reduced from 11s 6d to 7s 6d (plus P.T. 1s 4d).

Atlas Lighting, Ltd., announces that with effect from 4th August, the price of its 8ft 125 W fluorescent tubes has been reduced by 12½ per cent to 17s 6d each and of its 12in and 9in fluorescent tubes, from 10s to 7s 6d each.

Trade Announcements

The London sales office of **Rosite, Ltd.,** is now 27-31, Garman Road, Park Estate, Tottenham, N.17.

Mr. J. D. Sutton, B.Sc., A.R.I.C., has been appointed full-time Midlands area representative for **London Transformer Products, Ltd.,** operating from Carver House, Stourbridge Road, Wombourne, near Wolverhampton, Staffs.

The Glasgow regional headquarters office of the **A.E.I. Lamp & Lighting Co., Ltd.,** has been moved to 53, Pitt Street (telephone: City 6585).

The telephone number of **Solus-Schall, Ltd.,** has been changed to Museum 5080.

Davis & Timmins, Ltd., have concluded an arrangement with **Tappex Thread Inserts, Ltd.,** whereby they will act as sole distributors and stockists of the "Tappex" range of patented self-tapping thread inserts.

Light Soldering Developments, Ltd., have moved to 28, Sydenham Road, Croydon, Surrey. The telephone number, Croydon 8589, remains unchanged.

The General Electric Co., Ltd., and **Wild-Barfield Electric Furnaces, Ltd.,** announce that the repair and maintenance service for all G.E.C. valve-operated high-frequency generators will in future be carried out by Wild-Barfield from their works at Otterspool Way, Watford By-Pass, Watford, Herts (telephone: Watford 26091).

Matthew Hanna & Co., 138, Great Victoria Street, Belfast (telephone: Belfast 29184), have been appointed as agents for Northern Ireland for the products of the **Stonebridge Electrical Co., Ltd.**

The offices and works of **Miles Hivolt, Ltd.,** at 91, Princedale Road, London, W.11, are being moved to Shoreham, and as from 1st September the company's address will be Shoreham Airport, Sussex. The Manchester office remains at Tenax Road, Trafford Park, Manchester, 17.

The Electric Construction Co., Ltd., has opened area offices for the north of England at Lloyds Bank Chambers, Westgate Road, Newcastle-upon-Tyne, 4. The area will be in charge of Mr. N. J. Gould, previously of the Newcastle office of the Brush Electrical Engineering Co., Ltd.

Stream-Line Filters, Ltd., has moved to Henley Park, Normandy, near Guildford, Surrey (telephone: Normandy 3311/2), the headquarters of the parent company, Vokes, Ltd.

Ellvin & Co., Ltd., producers of metal pressings, spinnings and fabrications for the electrical trade, have moved to 17, Willow Lane, Mitcham, Surrey (telephone: Mitcham 9241/2).

CIBA (A.R.L.), Ltd., Duxford, Cambridge, has produced a neat and strong loose-leaf binder to accommodate future issues of its Technical Notes. The binder can be obtained from the company at 6s 6d post free.

The **Anglo-Swiss Screw Co., Ltd.,** has opened a new Coventry office under the direction of Mr. A. Elson, 8, Queens Road, Coventry (telephone: Coventry 22469).

Thermair Domestic Appliances, Ltd., have moved to Izons Lane, Oldbury Road, West Bromwich (telephone: West Bromwich 2837).

British Insulated Callender's Cables, Ltd., announces that the telephone number of its "Panelec" Heating Division, previously "Panelec" (Great Britain), Ltd., is now Museum 1600.

Geo. Becker, Ltd., has appointed **Compac (Electronics), Ltd.,** 1, Gower Street (Bedford Square), London, W.C.1 (telephone: Museum 9777), as its sole distributors for Southern England and South Wales.

Venner, Ltd., has opened a London servicing headquarters named Venner House in Ebury Street, Victoria, S.W.1, for the periodic overhaul and service of London parking meters. The building has four display windows showing the activities of the company, including time switch applications, accumulators and electronics.

The Alberice Meter Co. has removed its head office and factory to 87-89, Sterte Avenue, Poole, Dorset. Its London office is now at 371, West Green Road, N.15.

Evershed & Vignoles, Ltd., have removed their Scottish area office to 30, Rutland Square, Edinburgh, 1. The telephone number (Fountainbridge 3056) is unchanged.

The telephone number of **Renold Chains, Ltd.,** Bush House, Aldwych, London, W.C.2, is now Covent Garden 0673.

The Glasgow branch of the **Simplex Electric Co., Ltd.,** is now at 16/40, Ruby Street, Glasgow, S.E.

By mutual agreement **Westool, Ltd.,** ceased to act as selling agents for **A. P. Besson and Partner, Ltd.,** as from 1st August.

The Firth Cleveland Group, which includes Firth Cleveland Instruments, Ltd., Max Stone, Ltd., Civic Radio Services, Ltd., and Escott Bros., Ltd., has moved its headquarters to Stornoway House, Cleveland Row, St. James, London, S.W.1 (telephone: Whitehall 2166).

Decca Radar, Ltd., has purchased the lease of Cowes Airport and will be establishing a manufacturing unit there in the near future.

Change of Address

The Electric Light Fittings Association has moved to Regent House, 89, Kingsway, London, W.C.2. The telephone number (Holborn 4608/9) is unchanged.

Change of Name

The Baldwin Instrument Co., Ltd., has changed its name to Baldwin Industrial Controls.

I.E.E. Section Elections

THE election of Sir Willis Jackson, D.Sc., D.Phil., Dr.Sc.Tech., M.I.Mech.E., F.Inst.P., F.R.S., as President of the Institution of Electrical Engineers for the 1959-60 session, together with the new vice-presidents and members of the Council, was reported in our issue of 19th June. The names of the chairmen and new committee members of the specialised Sections have since been announced and are given below.

Electronics and Communications: Chairman, Mr. M. J. L. Pulling, C.B.E., M.A. (Controller, Television Service Engineering, B.B.C.); vice-chairman, Mr. J. A. Ratcliffe, O.B.E., M.A., F.R.S.; members, Messrs. P. A. T. Bevan, C.B.E., B.Sc., J. Brown, M.A., Ph.D., L. J. I. Nickels, B.Sc.(Eng.), N. C. Rolfe, B.Sc. (Eng.), and C. Williams, B.Sc.(Eng.).

Measurement and Control: Chairman, Prof. A. Tustin, M.Sc. (Professor of Heavy Electrical Engineering and Head of the Department of Electrical Engineering, Imperial College of Science and Technology, University of London); vice-chairman, Mr. W. S. Elliott, M.A.; members, Messrs. S. N. Pocock, W. Renwick, M.A., B.Sc., G. F. Tagg, Ph.D., B.Sc., R. D. Trotter, B.Sc.(Eng.), and J. H. Westcott, B.Sc.(Eng.), Ph.D.

Supply: Chairman, Mr. J. R. Mortlock, Ph.D., B.Sc.(Eng.) (chief engineer, M-V Power Systems Engineering Department); vice-chairmen, Messrs. D. B. Irving, B.Sc., and J. E. L. Robinson, M.Sc.; members, Messrs. C. J. O. Garrard, M.Sc., W. D. Horsley, D. McDonald, B.Sc., and T. W. Wilcox.

Utilisation: Chairman, Mr. T. E. Houghton, M.Eng. (formerly power department manager and a director of I.C.I. (General Chemicals), Ltd.); vice-chairman, Mr. H. G. Taylor, D.Sc.(Eng.); members, Messrs. J. R. Anderson, T.D., B.Sc.(Eng.), J. A. Broughall, B.Sc.(Eng.), O. T. Evans and J. Tozer.

New Scottish Centre Group

A proposal from the Scottish Centre of the Institution of Electrical Engineers that a Joint Electronics and Measurement Group should be formed in Scotland was approved by a Council meeting on 25th June. The Group will deal with the subjects covered by two of the specialised sections of the Institution, the Electronics and Communications Section and the Measurement and Control Section. An interim committee to control the Group's activities during the 1959-60 session was nominated at a meeting of the centre held in Glasgow on 21st July, and elections will be held next spring to form a Group committee under the direction of the Scottish Centre.

PERSONAL AND SOCIAL

Birthday Honours.—In our issue of 19th June we reproduced the portrait of **Mr. Leslie Gamage,** chairman and managing director of the General Electric Co., Ltd., who had a knighthood conferred on him in the Birthday Honours. The full list included the names of the following men in the electrical and allied fields:—

C.B.E.: Mr. F. H. S. Brown, a member of the Central Electricity Generating Board; **Mr. J. Henderson,** chief engineer, South of Scotland Electricity Board.

O.B.E.: Mr. C. R. Allen, lately superintending electrical engineer, Admiralty; **Mr. J. D. Beard,** assistant manager, Egatube Division, Ega Electric, Ltd.; **Mr. A. M. Beresford-Cooke,** head of planning and construction, Engineering Department, Independent Television Authority; **Mr. R. C. Harman,** head of operations and maintenance, Engineering Department, Independent Television Authority; **Mr. C. J. V. Lawson,** engineer-in-chief, Cable & Wireless, Ltd.; **Mr. G. A. Plummer,** director and chief engineer, John Thompson Water Tube Boilers, Ltd.; **Mr. W. S. Procter,** chief regional engineer, London Telecommunications Region, G.P.O.; **Mr. W. R. T. Skinner,** deputy chairman, South Eastern Electricity Board; **Mr. N. C. Smart,** chief engineer (telephone and exchange systems), General Electric Co. Ltd., Coventry; **Mr. C. J. Strother,** assistant to the chief engineer, British Broadcasting Corporation; **Mr. W. R. A. Taylor,** deputy works manager, Capenhurst Works, Industrial Group, U.K.A.E.A.; **Mr. W. A. J. Thorn,** deputy director, telecommunications, Ministry of Transport and Civil Aviation; **Mr. W. R. Tyson,** telephone manager, Bournemouth, G.P.O.; and **Mr. T. D. Murphy,** electrical superintendent, Belize Electricity Board, British Honduras.

M.B.E.: Mr. C. Allsop, chief research engineer, Bruce Peebles & Co. Ltd.; **Mr. P. Armstrong,** superintendent, erecting shop, W. H. Allen, Sons & Co. Ltd.; **Mr. A. L. Budd,** chief telecommunications superintendent, Air Ministry; **Mr. F. J. H. Clarke,** senior telecommunication superintendent, Long Distance Area, G.P.O.; **Mr. W. H. Dixon,** electricity service manager, March, Eastern Electricity Board; **Mr. T. A. Hough,** works manager, D. P. Battery Co., Ltd.; **Mr. C. H. Lewis,** area engineer, Telephone Manager's Office, Bristol, G.P.O.; **Mr. B. Pringle,** manager, Motor Engineering Department, Rugby, British Thomson-Houston Co., Ltd.; **Mr. A. Rodger,** electrical manager, William Denny & Brothers, Ltd.; **Mr. N. Walker,** senior executive engineer, Engineer-in-Chief's Office, G.P.O.; **Mr. R. F. Walls,** district manager, North of Scotland Hydro-Electric Board, Orkney; and **Mr. S. L. Burgess,** manager, State Electricity Department, Qatar.

Mr. L. F. Robson, B.A., A.M.I.E.E., appointed deputy chief commercial officer of the London Electricity Board. He is at present commersial officer, Tees Sub-Area, North Eastern Electricity Board.

Mr. C. P. Haigh, B.Sc., Ph.D., F.Inst.P., appointed director of the Berkeley Nuclear Laboratories of the Central Electricity Generating Board.

Sir Roger Makins is to succeed **Lord Plowden** as chairman of the United Kingdom Atomic Energy Authority on 1st January next. Lord Plowden, as we have already reported, will become chairman of the British Aluminium Co., Ltd., and vice-chairman of Tube Investments, Ltd., on 1st January next.

Mr. Stanley F. Steward, who was appointed director-designate of the British Electrical and Allied Manufacturers' Association in February, takes over executive responsibilities on 1st August. **Col. B. H. Leeson,** director since 1945, relinquished his position on 31st July but is remaining in a consultative capacity until his retirement next year.

Mr. D. Maxwell Buist, export director of the B.E.A.M.A., is to retire on 30th April next when he reaches normal retiring age. From 1st October next until that date he will relinquish full-time executive duties and serve in a consultative capacity.

At a meeting of the board of directors of the General Electric Co., Ltd., held on 25th June, **Mr. T. W. Heather,** M.C., and **Mr. R. E. Robinson,** both assistant managing directors, and **Sir Patrick Ashley Cooper,** a director, intimated their desire to retire during the present financial year in order to give opportunities for the promotion of younger men. The board has appointed **Mr. A. L. G. Lindley** vice-chairman and a managing director of the company.

Mr. P. J. Grant, Ph.D., chief physicist, Atomic Energy Division, General Electric Co., Ltd., appointed to the London University readership in Engineering Science tenable at the Imperial College of Science and Technology.

Mr. B. L. Scott, B.Sc., A.M.I.E.E., appointed manager of the Manchester and District branch office of George Ellison, Ltd., in succession to **Mr. A. Ansell,** Associate I.E.E., who will remain to assist Mr. Scott in a consultative capacity until the end of the year, when he retires after forty-six years' service with the company. **Mr. K. B. Oulton** succeeds Mr. Scott as manager of the Newcastle-upon-Tyne branch office. He joined the sales staff of George Ellison, Ltd., in 1945.

Mr. R. H. Jeffery, northern division sales manager of A.E.I.-Hotpoint, Ltd., appointed southern division sales manager. **Mr. J. M. Donald** appointed northern division sales manager.

Mr. W. A. Storey, A.M.I.E.E., appointed to succeed **Mr. E. C. Scott** as system operation engineer to the North Eastern Division of the C.E.G.B.

Mr. H. E. R. Thomas, sales manager, British Driver-Harris Co., Ltd., appointed commercial director. **Mr. E. Shuttleworth,** technical adviser to the president of Driver-Harris, Harrison, N.J., appointed a director of the British company.

Mr. H. Richards has resigned as chairman of Wolf Electric Tools (Holdings), Ltd., but retains his position as a director of the company. **Mr. G. M. Wolfe** has succeeded him as chairman and has been appointed managing director.

New appointments arising from sales reorganisation are announced by Morphy-Richards, Ltd. Plans for still further expansion of the group activities have made necessary the creation of a new executive post to be known as group marketing manager and **Mr. D. A. Reader,** a director of Spottiswoode Advertising, Ltd., has relinquished that position in order to become the group marketing manager with Morphy-Richards.

Following the resignation of **Mr. A. W. Sinclair,** sales manager of Astral Equipment, Ltd., a wholly owned subsidiary, to take up a new appointment, the Sales Department has been reorganised. **Mr. D. C. Richards** becomes general sales manager and **Mr. B. Condie,** assistant sales manager. A separate department, to be known as the Gas Division, has been established of which **Mr. P. N. Horton** will be the commercial manager.

Mr. O. Rendell has tendered his resignation, on account of ill-health, from the position of works director of H. W. Kearns & Co., Ltd. He remains a director of the company and his services as a consultant have been retained. **Mr. G. R. J. Hallam** has been appointed a director and also works director, and **Mr. C. E. Lowndes** has been appointed works manager.

Square D, Ltd., has announced the appointment of **Mr. R. G. Camp** as its headquarters sales manager. The vacancy of northern area manager has been filled by **Mr. K. W. Liller,** formerly a field engineer based at the company's Birmingham office.

Mr. G. W. T. Hall has been appointed manager of the new Bristol branch office of Square D, Ltd., which has been opened at 46, Queen Square, Bristol, 1 (Telephone: Bristol 20995).

Mr. S. H. Moore, manager of the Leeds branch of Allen West & Co., Ltd., Brighton, since the branch was opened in 1925, retired on 31st July. He has been succeeded by **Mr. F. A. W. Austin,** who has been at the Leeds office since 1934.

Mr. R. Boissevain appointed to the board of Merchant Adventurers of London, Ltd., lighting fittings manufacturers.

Mr. J. Biggs appointed sales lighting engineer for the Manchester area of Holophane, Ltd.

Sir Rex Hodges, J.P., has relinquished the office of chairman of W. T. Glover & Co., Ltd., but remains on the board as deputy chairman. **Mr. D. T. Hollingsworth,** M.I.E.E., M.Amer.I.E.E., director and general manager, has been appointed chairman and **Mr. J. H. Maxwell,** director and deputy general manager, succeeds him as general manager.

Mr. C. W. Miller, D.Sc., of the Metropolitan-Vickers Electrical Co., Ltd. (representing the British Employers' Confederation), and **Mr. C. R. Adams,** B.Sc., F.Inst.P., of the Central Electricity Generating Board (representing the nationalised industries), appointed members of a panel of experts being set up under the ægis of the Radioactive Substances Advisory Committee to consider safety and health questions arising from the use of ionising radiations in relation to persons working in research laboratories and research establishments (other than hospital research establishments).

Mr. O. M. Roberts, sales director of B & R Relays, Ltd., retired on 30th June.

Mr. G. E. Searson, northern general manager of the Ruberoid Co., Ltd., retired on 8th July after forty years' service with the company. He is succeeded by **Mr. T. J. Birtles,** who has been a Ruberoid senior executive for many years.

To assist Mr. Birtles in the supervision of the Contract Division's activities in the north, **Mr. D. T. Booth** has been appointed Newcastle branch manager and he is succeeded as manager of the branch office at Nottingham by **Mr. A. T. McManus,** who has been with the company since 1949.

Mr. G. R. Pryor, M.I.Prod.E., chairman and managing director of Edward Pryor & Son, Ltd., elected president of the Institution of Production Engineers for 1959-60. **Mr. R. H. S. Turner,** M.A. (Cantab.), director and works manager of the Metropolitan-Vickers Electrical Co., Ltd., re-elected vice-president and **Mr. H. W. Bowen,** O.B.E., chairman of Damic Controls, Ltd., re-elected chairman of the Council.

Brigadier M. H. Cox has resigned from the post of resident director of the Indian Steelworks Construction Co., Ltd., at Durgapur as from 10th August. **Mr. D. J. Bell,** general manager, Durgapur steel project, appointed to succeed Brigadier Cox as resident director.

Mr. C. M. Cawley, C.B.E., D.Sc., F.R.I.C., appointed chief scientist to the Ministry of Power in succession to **Sir Kelvin Spencer,** C.B.E., who has retired.

Mr. H. S. Wilkinson, A.M.I.Mech.E., senior assistant transmission engineer (construction) in the Midlands Division of the C.E.G.B., is retiring after forty-six years in the electricity supply industry.

Mr. L. Dobson, engineering director of Imperial Chemical Industries, Ltd., Plastics Division, is leaving I.C.I., Ltd., at the end of August and is joining the board of Simon-Carves, Ltd.

Mr. Howard Long, M.I.E.E., F.I.E.S., has retired from the Benjamin Electric, Ltd., after thirty years' service and is acting as a consulting engineer, lighting specialist. Mr. Long's private address is 58, George's Wood Road, Hatfield, Herts (telephone: Potters Bar 3701).

Mr. W. A. G. Brian appointed secretary/accountant of Marconi Instruments, Ltd., in succession to **Mr. C. Stanier,** A.C.I.S., F.I.A.C., who has retired after nearly thirty years in the service of the Marconi companies.

Mr. R. J. Smith, M.Sc.Tech., A.M.I.E.E., appointed to take charge of the organisation which the General Electric Co., Ltd., is setting up in Japan to supervise the building of a 150 MW nuclear power station. Mr. Smith, who has been chief projects engineer of the company's Atomic Energy Division, left this country to take up his new post in Tokyo on 20th July.

Mr. H. E. S. Fitch appointed to the board of Best & May, Ltd.

Mr. A. M. Moat appointed commercial manager of Servomex Controls, Ltd., Crowborough, Sussex.

Mr. H. C. White (Philips Electrical, Ltd.) has been elected chairman of the Electric Lamp Industry Council for the ensuing year. Mr. White has served on many committees concerned with electric lamps and is a member of the Council of Management of the British Lighting Council.

Mr. G. Hughes, M.I.Mar.E., deputy superintendent at Barony power station, South of Scotland Electricity Board, appointed superintendent, Yoker power station, in succession to **Mr. J. L. Blue** who has retired.

Mr. H. G. Lawson appointed general manager of the Hallamshire Steel Co., Ltd. He is an executive director and has been secretary of the company for many years.

Mr. F. Foulkes, general president of the Electrical Trades Union, elected president of the Confederation of Shipbuilding and Engineering Unions.

Mr. L. J. Brown, who joined the Gramophone Co., Ltd., in 1927, has relinquished his office of managing director of Electric & Musical Industries, Ltd., but will continue to be a director of the company.

Mr. J. Westoll, of Dykeside, Longtown, Cumberland, appointed a part-time member of the North Western Electricity Board. **Mr. J. R. Potts,** O.B.E., J.P., of Carlisle, has retired from the Board on completion of his term of office.

Mr. F. Booth, B.Sc.Tech., appointed chief engineer to the Accumulators and Batteries Division of Siemens Edison Swan, Ltd., at Ponders End, Middlesex, in succession to **Mr. H. S. Greenough,** whose services will be available in a consultative capacity for a period of twelve months.

Mr. P. V. G. Lintzgy appointed manager of the Operating Division of the Marconi International Marine Communication Co., Ltd. He succeeds **Mr. J. T. Marler,** who retired on 30th June after fifty-two years' service with the company. **Mr. W. J. Rattray** appointed manager, Glasgow depot, in succession to **Mr. J. P. Dawson,** who has retired.

Mr. E. Leith of Klaxons, Ltd., is retiring after forty-seven years' service with the company. He has been manager of the Service Department since the 1914-18 war.

The Electricity Council has appointed **Mr. A. Corney,** B.Sc.(Eng.), A.M.I.E.E., to be chief safety officer. Mr. Corney, who is at present deputy chief safety officer, succeeds **Mr. H. Midgley** who retires at the end of August.

Messrs. J. N. Gibson, J. R. McDonald, B.Sc.(Eng.), A.M.I.E.E., and **D. M. H. Rooney,** M.A., A.M.I.E.E., appointed executive directors of British Insulated Callender's Construction Co., Ltd.

Mr. L. A. Huntington, A.R.I.C., M.I. Fuel., previously divisional chief chemist with the Yorkshire Division, C.E.G.B., appointed chemist for the North Eastern Division.

Mr. J. T. Kendall, M.A.(Cantab.), Ph.D.(London), F.Inst.P., A.R.I.C., A.M.I.E.E., F.R.S.E., appointed general manager, marketing, of Texas Instruments, Ltd., and **Mr. J. Powell,** B.A., D.Phil., promoted general manager, technical, in place of Dr. Kendall.

Major-General S. W. Joslin, C.B., C.B.E., M.A., M.I.Mech.E., M.I.E.E., has been appointed chief inspector of nuclear installations to advise the Minister of Power on the measures to be taken under the Nuclear Installations (Licensing and Insurance) Act.

Mr. T. P. Summerton, general sales manager of H. J. Baldwin & Co., Ltd., appointed an additional director of the company.

Mr. H. J. Beach, Assoc. Brit. I.R.E., has joined B. & R. Relays, Ltd., as sales manager.

At the annual meeting of the Scientific Instrument Manufacturers' Association of Great Britain held in London on 2nd July, **Mr. L. A. Woodhead,** managing director of Cossor Instruments, Ltd., was inaugurated as president and **Mr. G. C. Ottway,** managing director of W. Ottway & Co., Ltd., became president-elect. **Mr. A. W. Rundle** (A. Gallenkamp & Co., Ltd.), has succeeded **Mr. P. J. Ellis,** O.B.E. (R. B. Pullin & Co., Ltd.), as hon. treasurer, and **Mr. E. R. Ponsford** (Solartron Electronic Group, Ltd.) succeeds **Mr. W. H. Storey** (Unicam Instruments, Ltd.) as hon. secretary.

Mr. J. W. Simpson, O.B.E., has relinquished the editorship of "Electricity," the journal of the Electricity Council. Mr. Simpson is well known in the industry, principally as secretary of the British Electrical Power Convention. He originally held editorial responsibility for the "I.M.E.A. Journal" which was started nearly thirty years ago. He has been succeeded as editor of "Electricity" by **Mr. G. Morley Davies,** press and information officer to the Council.

Mr. W. Fraser has been appointed a director of British Insulated Callender's Cables, Ltd. **Mr. W. G. Hendrey,** M.I.E.E., has retired from the company, of which he has been a director since 1938. He joined the former Callender's Cable & Construction Co., Ltd., in 1903.

At the annual general court of the Royal Commercial Travellers' Schools on 24th June, **Sir Leslie Gamage,** chairman of the General Electric Co., Ltd., was re-elected president for a further term of three years.

The **Worshipful Company of Tin Plate Workers** has made fifteen awards for its 1959 travelling scholarships.

Mr. E. Seymour-Semper, M.I.Mech.E., has been elected president of the Institute of Welding for 1959-60. **Mr. W. Barr,** O.B.E., A.R.T.C., and **Mr. E. Fuchs,** M.A., A.M.I.Mech.E., are the two new vice-presidents.

Mr. A. W. Sinclair has joined Parkinson Cowan Appliances, Ltd., as sales manager of the Electrical Division. Before joining the company he was sales manager of the Gas and Electrical Divisions of Astral, the Morphy-Richards subsidiary.

Mr. E. C. Willis, F.C.I.S., Companion I.E.E., who has been deputy chairman of the South Western Electricity Board since 1956, retired on 31st July on completion of his term of office. He has been succeeded as deputy chairman by **Mr. S. F. C. Whitmore,** A.M.I.E.E., who has been a full-time member of the Board since 1st April last and was formerly manager of the Eastern Electricity Board's Chilterns Sub-Area.

Mr. L. Edgar has relinquished his appointment as group publicity manager of the John Thompson group of companies. He will, however, continue to serve the group in an advisory capacity on publicity and press matters. **Mr. D. H. Edson,** assistant publicity manager, has been appointed group publicity manager, and **Mr. G. O. Ham** has been appointed assistant group publicity manager.

Mr. R. H. Burdett, B.Sc.(Eng.), A.C.G.I., A.M.I.Mech.E., A.M.I.E.E., of the Research and Development Department of the Central Electricity Generating Board, has been appointed deputy director (mechanical) in the Applications Branch, Research and Development Department, of the Board.

Mr. C. R. Wheeler, C.B.E., has been elected a director of Associated Electrical Industries, Ltd. He is joint managing

director of Guest, Keen Iron & Steel Co., Ltd., chairman of B.I.S.C.(Ore), Ltd., and a director of other companies.

Mr. C. Addis, M.B.E., B.E.M., has been appointed works manager, Swansea Works, Birmingham, of Bulpitt & Sons, Ltd., in succession to the late Mr. Frank Ashton, M.B.E., under whom Mr. Addis served in the Holloware and Engineering Departments.

The **Electrical Industries Benevolent Association** has received a legacy of £500 from the estate of the late Mr. Frank C. Thomas of Bertram Thomas, Ltd., Manchester.

The Windsor Group of companies announce that **Mr. R. E. G. Windsor,** managing director, has also been appointed chairman. The group comprises R. H. Windsor (Holdings), Ltd., Webley & Scott, Ltd., Klaxon, Ltd., R. H. Windsor, Ltd., and its home and overseas subsidiaries. **Mr. A. Dennis,** due to ill-health, has resigned from all the boards of the group and has relinquished all his executive positions therein.

Mr. T. Coughtrie, C.B.E., J.P., chairman and managing director of the Belmos Co., Ltd., has been appointed a director of the North British Locomotive Co., Ltd.

Mr. C. B. Speedy, Ph.D., B.E.(Hons.), has been appointed to the board of Lion Electronic Developments, Ltd.

Mr. F. T. Lovell has joined the sales force of the Midland Electric Manufacturing Co., Ltd., in London.

Sir Geoffrey Summers, Bt., C.B.E., O.St.J., of Dyserth, Flintshire, and **Mr. C. M. Jones,** M.B.E., J.P., of Bala, Merioneth, re-appointed part-time members of the Merseyside and North Wales Electricity Board.

Mr. N. E. Rigler has been appointed assistant publicity manager of E. K. Cole, Ltd.

Mr. J. A. E. Trinder has been appointed a director of George E. Taylor & Co., Ltd., electrical and mechanical engineers and contractors, and will be responsible for contract development and purchasing. George E. Taylor & Co. is a subsidiary of the Turriff Construction Corporation, Warwick. Mr. Trinder will take up his new appointment on 1st September when he leaves Siemens Edison Swan, Ltd., as London district manager.

Mr. H. W. Carter, T.D. (solicitor), divisional secretary of the South Wales Division, C.E.G.B., has been appointed regional secretary of the Southern, South Western and South Wales Region of the Board from 1st August.

Mr. S. A. E. Barrow has relinquished his position with Stone & Webster Engineering, Ltd., to join the board of Delta Technical Services, Ltd.

Mr. P. L. Lowrie, B.Sc., A.M.I.E.E., and **Mr. W. H. D. Campbell,** M.A., F.C.A., have been appointed directors of the British Geco Engineering Co., Ltd., Induction Heating Division, Edenbridge, Kent.

The annual sports and gala of the **General Electric Co., Ltd.,** were held on 4th July at the company's sports ground, Wembley, in brilliant weather. The Leslie Gamage Trophy for the leading London establishment was won by the Research Establishment. Many members of the board were present, including Sir Leslie Gamage (chairman and managing director), who was accompanied by the Hon. Lady Gamage, and at the conclusion of the programme of events Lady Gamage presented the prizes. Following the sports there was dancing in the evening in Hirst Hall.

Mr. J. H. Appleby, A.M.I.E.E., M.I.Mech.E., M.Am.I.E.E., chief engineer of the Compania Anonima Luz Electrica de Venezuela, is in this country on vacation until 24th September. Communications can be sent to him at the Canning Club, 1, Hamilton Place, Piccadilly, London, W.1.

Mr. C. H. Etherington and **Mr. T. D. G. Wintle** appointed to the board of Crabtree Electrical Industries, Ltd. **Dr. H. Schofield** has resigned from the board.

Mr. F. J. Thompson is the new manager of the Brighton branch of the General Electric Co., Ltd.

The Electricity Council is inviting applications for the position of research adviser who will be responsible for advising and assisting the Council in preparing and carrying out co-ordinated programmes of research within the electricity supply industry in England and Wales. The salary is in the range of £4,000-£4,500.

OBITUARY

Mr. W. T. Ditcham.—The death has occurred, at the age of seventy-eight, of Mr. William Theodore Ditcham, who, until he retired in 1949, was assistant to the engineer-in-chief of Marconi's Wireless Telegraph Co., Ltd. Mr. Ditcham was concerned during the first quarter of the present century with the development of radio telephony and during his long association with the Marconi Company, which he joined in 1915, he was particularly associated with the building of broadcasting transmitters and the initiation of broadcasting in this country in 1920, operating the experimental service from Chelmsford.

Mr. W. J. Henton Jones, D.S.O., R.D., A.M.I.Mech.E., M.I.Mar.E., station superintendent of Agecroft "B" power station of the North West, Merseyside and North Wales Division of the C.E.G.B., died on 7th June after his return from the British Electrical Power Convention at Torquay.

Mr. L. K. Everitt, a director of Edgar Allen & Co., Ltd., and general manager of the Steel Department, died recently while on a visit to the subsidiary company, Acieries d'Hirson, in Paris. Mr. Everitt was the son of the late Mr. C. K. Everitt, former chairman of the company.

Mr. J. Watson, who relinquished his appointment as manager of the Cardiff branch of Crompton Parkinson, Ltd., owing to ill-health and became lighting engineer with special duties at the London office, died on 22nd June. One of his most recent lighting projects was the design and planning of the lighting installation for the new nuclear power station at Trawsfynydd.

Mr. W. Stuart.—The death occurred recently of Mr. Walter Stewart, A.M.I.E.E., formerly assistant superintendent of the Transformer Department of the Metropolitan-Vickers Electrical Co., Ltd.

Mr. P. Evans, a former director of Pinchin, Johnson & Co., died on 24th May, at the age of seventy-three.

Mr. Roy Stuart Jones, M.I.E.E., former manager of the Plant Sales Department of the British Thomson-Houston Co., Ltd., died on 6th July in a Stirling nursing home while on holiday. Mr. Jones was with the B.T.H. Co. for forty-two years and retired in 1954.

Mr. W. H. Dodd, sales engineer of Ottermill Switchgear, Ltd., died recently at the age of fifty-one.

Viscount Weir of Eastwood, G.C.B., hon. president of G. & J. Weir, Ltd., died on 2nd July at the age of eighty-two. Viscount Weir was the son of James Weir, the inventor of the Weir pump and was apprenticed to G. & J. Weir, Ltd., at the age of sixteen, of which company he subsequently became managing director and later chairman. On his retirement as director and chairman in 1955 he was appointed first honorary president of the Weir group of companies.

Sir Ronald Matthews, a former chairman of the Brush Group, Ltd., died on 1st July at the age of seventy-four. He had been deputy chairman of the Independent Television Authority since 1955.

Mr. Arthur A. Rowse, C.B.E., late chairman of Venner, Ltd., S. G. Brown, Ltd., Langley Alloys, Ltd., and a director of other companies, died on 27th June.

Mr. Archibald Harry Langford, M.Inst.Prod.E., director and general manager of Heenan & Froude, Ltd., Worcester, died on 19th July, at the age of sixty-four.

Mr. E. F. Kerridge, who was in charge of the Technical Publications Department at Enfield of the Ferguson Radio Corporation, Ltd., died recently at the age of forty-five.

Mr. E. A. Loeb, a director and co-founder of Londex, Ltd., died suddenly on 25th July.

Mr. E. J. Jordan, former district engineer at Barking of British Insulated Callender's Construction Co., Ltd., died on 20th July, at the age of seventy.

Mr. Frederick Nock, chief accountant of the Midlands Electricity Board, was found dead on 29th July in a Cambridge Hotel. He was sixty-one.

Electricity Council Chairmanship

The Minister of Power has appointed **Mr. C. R. King,** C.B.E., to be chairman of the Electricity Council in succession to **Sir Henry Self,** K.C.B., K.C.M.G., K.B.E., who retires on 31st August after serving as chairman since the Council's formation two years ago; he was previously deputy chairman of the Central (formerly British) Electricity Authority. Mr. King has been deputy chairman of the Central Electricity Generating Board since its formation and was previously chairman of the East Midlands Electricity Board. **Professor R. S. Edwards,** who is at present a part-time deputy chairman of the Electricity Council, will serve full-time from 1st October.

Mr. C. R. King

Sir Henry Self

HARWELL REACTOR SCHOOL

By J. F. HILL, B.Sc.*

The new Harwell school

A short description of the various types of courses at present being held at the Reactor School at Harwell is given and the history of the school and the attendance at previous courses are surveyed

THE Reactor School was started in September, 1954, with the specific purpose of training members of the design teams from the four consortia who were to submit tenders for the design of the first British nuclear power stations. The first tenders were due to be submitted by 1st October, 1956, and, so that the school could open as soon as possible, it was housed in temporary hutting outside the main establishment perimeter at Harwell and the first course started in September, 1954.

The course was intended primarily for engineers and physicists of good degree standard although no particular qualifications were insisted upon. This has been the case ever since and to date it has been found that almost without exception the students who attend the school come up to the required standard.

The first course was "classified" and so only British students attended. There was a total of 40 students. Of these, 29 were from outside Harwell and comprised five from each of the consortia, three from the then British Electricity Authority, one consultant and five other representatives from industry. In addition, there were three representatives from industry who were attached to Harwell at the time and eight members of the Harwell staff. The 29 students who were not in any way connected with Harwell spent their whole time in the school, but the remainder only attended for lectures. This arrangement still operates, but the number of full-time students is now 60.

The course lasted twelve weeks and compared with the present courses was taken at a very leisurely pace. The total number of lectures was about 90, and for the first two weeks only one lecture was held each day. For the remainder of the course there were two lectures per day, both in the morning. The afternoons were occupied either by experimental work or by private study.

Because of the large-scale declassification brought about by the Geneva Conference in 1955, it became possible to hold unclassified courses and so include foreign students in the course. Accordingly the syllabus was extensively revised and the number of lectures increased. The first international course commenced in September, 1955, and included 15 full-time overseas students. The number of lectures was increased to about 120 and for the first time the students were taken on a visit to Calder Hall to see the reactors being built there.

A senior technical executives' course was held for the first time in 1956 and lasted for nine days. This course is still held regularly and is intended as an appreciation course for senior technical people in industry and the Central Electricity Generating Board. This first course, which was confined to British students, was held in Lincoln College, Oxford, and had 28 participants.

It had become apparent during the preceding year that the buildings occupied by the school were inadequate and so, during 1956, a new school was built outside the north perimeter of the establishment. This, which was opened in September, 1956, by Sir John Cockcroft, can accommodate 60 full-time students and has a large laboratory. The first course was a standard course and was increased in length to 14 weeks, with the laboratory work starting after the third week.

The four courses which were held in the period from May to August were all departures from previous practice. The first of these was a two-day course for technical journalists and was attended by 30 people. Its aim was to give the background to nuclear energy to people who had to write about it in the Press. This was followed by a six-week course which was essentially the first six weeks of the standard course, suitably treated so as to be self-contained. The aim of the course was to give a general outline of reactor engineering and physics, especially for those people who were not interested in having a great deal of detailed information. Six days of the course were devoted to experimental work and 65 people attended, only two of whom were not full time.

At this time, Harwell was receiving many requests from educational bodies to supply lecturers on a

* Principal, Harwell Reactor School.

variety of nuclear energy subjects. Many of these bodies were technical colleges who were wishing to run courses in nuclear engineering. So, in conjunction with the Ministry of Education, a two-week course was held at the end of July, 1957, for about 60 engineering lecturers from technical colleges in England, Scotland and Wales. The content of the course was similar to the senior technical executives' course but it also contained some experimental work.

The last new course was organised in conjunction with the O.E.E.C. for members of staffs of universities in O.E.E.C. countries, a similar course being also held at the French establishment at Saclay. This was organised as a specialists' course of two weeks' duration, the object being to acquaint university staff with the extent of the information in atomic energy which could be taught. The first week was devoted to the outlines of reactor engineering and reactor physics (in parallel sessions) along with background lectures in allied subjects such as chemistry, metallurgy and health physics. For the second week, the course divided into four sections: chemistry and chemical engineering; reactor physics and reactor theory; mechanical engineering; and electronics and particle accelerators. During October, 1957, the third senior technical executives' course was held and, for the first time, this was open to foreigners.

The arrangements for the standard course commencing in January, 1958, and subsequent courses were completely revised by dividing it into two parts. The first part, of six weeks' duration, is now held jointly at three colleges of advanced technology and the second part, now consisting of ten weeks, at the Reactor School. The three colleges are the College of Technology, Birmingham; the Bradford Institute of Technology; and the Royal Technical College, Salford, and about 20 students attend each college.

Lecturers from the colleges were themselves trained by attending the full standard course and four from each college (two engineering and two physics lecturers) have now been through the full course. These arrangements were made in conjunction with the Ministry of Education who themselves chose the colleges involved. One of the reasons for taking this step was to establish additional teaching in nuclear engineering and it is expected that these colleges will also run courses independent of the Reactor School course.

A further consequence of running the standard course in two parts is that students, particularly overseas students, may now take only the second part of the course if they can show that they are familiar with the more elementary parts which are treated at the technical colleges. It should be pointed out that this joint arrangement with the colleges of advanced technology has worked extremely well.

During 1958 there was no change in the courses other than that mentioned above. The only new course to be run was one on the control and instrumentation of reactors, from 6th to 11th October, in which a record number of 97 students took part. This course arose largely as a result of former students from standard courses asking for a more specialised and detailed treatment of the subjects. It is expected that further such specialised courses will be run in the future on these and other topics.

In addition to organising its own courses, the Reactor School has also assisted other nuclear engineering courses by offering to them the facilities of its laboratory. Students from the Mechanical Engineering Department of Southampton University visit the school each term to perform the experiments in the laboratory and the members of the Birmingham University M.Sc. course in reactor physics and technology also attend each year for the same purpose. A course of R.A.F. officers also attended the laboratory for one week during 1958.

Standard Course

As already mentioned, the standard course of 16 weeks' duration is now split into two parts: the first part at a college of advanced technology and the second part at the Reactor School. The purpose of the first part is to provide the fundamental background for the more technological second part and its aims are as follows:—(1) To provide background atomic and nuclear physics to engineers and basic engineering (fluid flow and heat transfer) to physicists. (2) To develop this basic information and extend it to consider, in an elementary way, the physics of reactors and of the cooling of reactors. (3) To give introductory lectures on other topics in the nuclear energy field such as chemistry, metallurgy and health physics. In addition to the lectures there is, of course, a considerable amount of experimental work designed to illustrate the topics discussed in the lectures.

The Harwell part of the standard course takes over where the colleges of advanced technology leave off and continues to develop the subjects already introduced. The lecture syllabus is approximately divided into three parts: reactor theory and reactor physics, reactor engineering and other nuclear energy subjects. The course is designed primarily for people who will be concerned with reactor design both from the physics and engineering aspects. The main emphasis is on the design of natural uranium, graphite gas-cooled reactors, as it is this type of reactor with which we have the most experience. It is recognised, however, that the student must also learn about other reactor types and also gain some knowledge of the other allied subjects which form part of the nuclear energy industry.

In the physics part of the syllabus, the plan is first to extend the basic reactor physics dealt with at the colleges where the treatment on the physics of reactors is largely non-mathematical. This is done by developing elementary reactor theory, largely in relation to natural uranium, graphite gas-cooled reactors. First, elementary neutron diffusion theory is introduced and its use demonstrated in the calculation of the thermal utilisation of a reactor. Neutron slowing down theory follows and the calculation of the resonance escape probability, followed by a discussion of the multiplication constant and the buckling. Diffusion theory is used to calculate the critical size of a bare reactor (a reactor without a reflector) and the dependence of the critical size and critical mass of fuel on the composition of the reactor core is found. The effect of a reflector on the critical size is next discussed and this is followed by a consideration of the effects which take place when a reactor is operated. The particular effects considered are fission product poisoning, temperature effects and the effects of changes in the composition of the fuel as it is burnt and as new fissionable material is produced. The change in the critical size of a reactor brought about by these changes is then calculated. This concludes the elementary part of the reactor theory, but lectures are given later in the course for those who are particularly interested in the theory. These include more advanced diffusion theory, advanced reactor kinetics and stability (elementary kinetics is dealt with at the colleges), temperature coefficients, xenon instability, control rod calculations and perturbation theory.

In addition to the theoretical lectures, there are lectures on the experimental aspects of the physics of reactors. Generally, these describe the methods and theory of those

Library in the new Harwell Reactor School

measurements which are required to determine the constants to fit into the theoretical formulæ concerned with the calculations for reactor design. Lectures are given on the use of reactor oscillators, exponential experiments, integral experiments, resonance integrals and zero energy thermal reactors. There are also lectures on the use of reactors for physics research, on the problem of reactor shielding (largely theoretical) and on fuel cycles in reactors.

The engineering lectures are roughly divided into two parts. One part deals with the problems with which the engineer has to deal in designing a reactor, including a discussion of the necessary research work, and the other part consists of discussions of the different reactor types. Elementary heat transfer has been dealt with at the colleges and this is then extended to more advanced problems in reactor cooling. The finning of fuel element cans is considered and heat transfers from roughened surfaces as well as heat transfer by boiling water. Experimental work in heat transfer is also discussed. Reactor control and instrumentation, the detection of burst cartridges, the design and purpose of loops in reactors, liquid metal technology, pumping both by mechanical and electromagnetic pumps, remote handling and reactor operation are all dealt with in the lectures.

During the course, more attention is, naturally, given to the Calder Hall type of reactor. There are lectures and discussions on Calder Hall itself and each of the four groups who are currently building nuclear power stations in the United Kingdom send a representative to lecture on and discuss their own particular design. Visits to one of the nuclear power stations now under construction are also arranged. The other reactor types which are discussed are water moderated and boiling water reactors, ship propulsion reactors, high-temperature gas-cooled reactors, the advanced gas-cooled reactor, fast reactors and to a lesser extent homogeneous aqueous, sodium graphite and liquid metal fuel reactors. The remainder of the lecture programme deals with a variety of topics, mainly in the fields of metallurgy, chemistry and chemical engineering and health physics.

The metallurgical lectures which again are a continuation of those given at the colleges deal with properties of materials used in reactors, fuel element fabrication, corrosion, including liquid metal corrosion, and the properties of ceramics and cermets. Problems in chemical plant design are discussed including the particular problems which arise in plant where fissionable material is present. The manufacture of reactor materials is also considered, particularly heavy water and graphite.

In addition to general lectures on health physics problems, special lectures are given on the problems of the containment of radioactivity, decontamination, the disposal of effluent, and the dispersal of airborne activity.

In general, four lectures of one hour's duration are given on three days each week, namely, Monday, Wednesday and Friday. The time not occupied on these days is devoted by the students to private study or the calculations on a simple design example of a gas-cooled reactor. The remaining two days in each week are devoted to experimental work and also to visits to laboratories and reactors of the Harwell establishment.

The experimental work is devoted almost exclusively to physics and engineering experiments but, in addition, the school laboratory experiments are also performed using the Harwell reactors GLEEP and BEPO. Three of the experiments are concerned with the problem of the cooling of reactor channels, the cooling fluids under investigation being air and water.

In the air cooling rig, the apparatus consists essentially of a section of a reactor channel where the fuel element is simulated by a heater element which has different fin forms. This is cooled by blowing air down the channel. The object of the experiment is to compare, for different fin arrangements, how much heat is extracted from the channel as a function of the pumping power. The well-known relation $Nu = 0{\cdot}023\ (Re)^{0{\cdot}8}\ (Pr)^{0{\cdot}4}$ is also verified.

The failure of a fuel element in a reactor could occur if the element becomes overheated due to lack of adequate cooling. This problem is investigated in the "burn-out" experiment where a heated metal specimen is cooled by water flowing over it. For simplicity, the "burnout" point is taken to occur when the specimen reddens and this point is measured for a variety of water flow rates and input heats to the specimen.

A further experiment demonstrates some of the properties of boiling water. The different phenomena associated with boiling are demonstrated in a tube containing a heater element, through which water flows. The flow rate can be varied and the temperature measured at different points along the tube. The density of the water leaving the tube is also found by measuring the attenuation of the rays from a γ-source.

The physics experiments in the school laboratory consist essentially of two stacks of graphite, one including uranium, and an electronic reactor simulator. The stack without uranium contains a neutron source and is used to measure both the slowing down and diffusion lengths in graphite. Foils are used to determine the appropriate neutron distributions, the main object of the experiments being to familiarise students with the techniques of foil counting.

The graphite stack containing uranium is called an exponential stack and is a portion of a reactor core. By means of a source inserted in its lower portion (which does not contain uranium), a thermal neutron distribution is created in the stack and, by measuring the appropriate characteristic of the distribution away from the source, the critical size of a reactor of the same composition as the stack can be calculated. The distribution in this case is measured by means of a BF_3 chamber.

The reactor simulator imitates the power response of a reactor to changes brought about by movement of the control rods or sudden changes in the reactivity. It is a particularly valuable device for studying the kinetic behaviour of a reactor.

STANDARD COURSE

British Students not including U.K.A.E.A.		U.K.A.E.A. Students		Overseas Students All full-time	Total Full-time	Total Lectures only	Total All students
Full-time	Attended lectures only	Full-time	Attended lectures only				
392	93	94	103	239	486	196	921

Both the GLEEP and BEPO reactors are used to measure neutron absorption cross-sections by the use of pile oscillators. The sample whose cross-section is to be measured is moved into and out of the reactor and by comparing the effect on the reactor with the effect caused by a sample of known cross-section the cross-section of the first sample can be found.

BEPO is also used for two further experiments. In one, the thermal neutron flux distribution across a radius of the cylindrical core is measured and it is also verified that the change in reactivity caused by a small absorber is proportional to the square of the flux at the point where the absorber is inserted. The other experiment using BEPO is one concerned with the problem of shielding. A beam of neutrons and γ-rays is directed into a tank attached to the side of the reactor. The tank is filled with water and the attenuation of the neutrons and γ-rays resulting from varying numbers of steel plates inserted into the tank, is measured.

Senior Technical Executives' Course

This course lasts for nine days followed by a visit to one of the nuclear power stations under construction. The aim of the course is to give an appreciation of the nuclear energy field to technical staff in senior positions who do not require the detailed information given in the standard course.

Lectures are given on elementary nuclear and reactor physics, metallurgy, heat removal from reactors, chemical engineering in atomic energy, reactor materials, research, power and propulsion reactors and the C.E.G.B. reactors, reactor control and instrumentation, health physics, effluent disposal, shielding and the United Kingdom power programme. There is no experimental work on this course, but there are several visits to reactors and laboratories at Harwell.

SENIOR TECHNICAL EXECUTIVES' COURSES

All British Students	Overseas Students	Total
245 (includes 7 U.K.A.E.A.)	53	298

Control and Instrumentation Course

It is now becoming apparent that there is a requirement for specialised courses in some of the topics which are treated only briefly on the standard course. The only such course held so far has been one on the control and instrumentation of reactors and was intended for those people whose special interest is in these subjects. This course lasted for nine days and the subjects discussed, after a preliminary revision of reactor kinetics, were: control and instrumentation, automatic control of reactors and nuclear power plants, application of computers, reactor transfer functions and function analysers, neutron flux scanning, radiation detectors and their siting in reactors, reactor safety circuits, conventional instrumentation, transistors in reactor instrumentation, burst slug detection, spatial instabilities in reactors and data reduction problems on large reactors.

CONTROL AND INSTRUMENTATION OF REACTORS COURSE

British Students not including U.K.A.E.A.	U.K.A.E.A. Students	Overseas Students	Total
47	21	29	97

The tables give details of the numbers of students who have attended the standard, senior technical executives' and control and instrumentation courses, and also the number who have attended these courses from the different overseas countries up to and including the standard course which ended on 5th March last, and the senior technical executives' course (9th-19th March).

DISTRIBUTION OF OVERSEAS STUDENTS ON THESE COURSE

Argentina	2	Korea	5
Australia	29	Luxembourg	1
Austria	5	Malaya	1
Belgium	26	Malta	1
Brazil	3	New Zealand	1
Canada	14	Norway	1
Ceylon	1	Pakistan	4
Chile	3	Peru	1
Denmark	22	Portugal	5
Egypt	3	South Africa	5
Finland	1	Southern Rhodesia	1
France	1	Spain	15
Germany	69	Sweden	9
Holland	23	Switzerland	4
India	9	Uruguay	1
Ireland	2	Yugoslavia	3
Israel	6		
Italy	19	Total	321
Japan	25		

The fee for the standard course is £250 and for the senior technical executives' course and the control and instrumentation course 50 guineas, exclusive of accommodation.

"Outer Seven" Draft Plan

THE two-day meeting last month in Stockholm of Ministers of the "Outer Seven" countries ended with a recommendation to the participating governments to go ahead with the establishment of the proposed Free Trade Area. Apart from the usefulness of the association in itself it was again emphasised that the purpose remained to facilitate the negotiations of a wider agreement with the Common Market and other members of O.E.E.C. The draft plan, which has been published as a White Paper (Cmnd. 823, price 1s), includes rules for the abolition of tariffs and quantitative restrictions, for ensuring fair competition and for identifying the goods which move freely between the members. The immediate objective is to reduce tariffs by 20 per cent on 1st July, 1960, and to complete the process of elimination of tariffs in steps of 10 per cent by 1st January, 1970. Members may reduce their own tariffs more rapidly, and during the eighteen months from next July members will examine whether the period of elimination could be shortened.

Following extensive inquiries in all sections of industry, the Federation of British Industries had previously announced its qualified approval of the proposed Free Trade Area of the Outer Seven. The F.B.I. stressed the desirability of the Government consulting with industry at an early stage on the detailed arrangements, and their belief in the continuing importance of this country's links with the Commonwealth and of the system of mutual preferences. In their answer to the F.B.I. questionnaire the B.E.A.M.A. said that the proposed Free Trade Area offered no direct benefits to the electrical industry. They did not consider electrical manufacture as a whole a "sensitive" industry but the effects of purchase tax, price cutting and different standards gave rise to "sensitivity" in certain products.

During the first two weeks of July the 1959 Grouped Meeting of the International Electrotechnical Commission was held in Madrid. In this article, our special correspondent gives a detailed account of the proceedings at the Council meeting and the meetings of the Committee of Action. A further report, dealing with the work of the Technical Committees, will be published next week

I.E.C. IN MADRID

FROM A SPECIAL CORRESPONDENT

THE 1959 Grouped Meeting of the International Electrotechnical Commission was held in Madrid from 29th June to 10th July. The I.E.C. Council and the Committee of Action, together with 30 Technical Committees and Sub-committees met in the headquarters of the Consejo Superior de Investigaciones Cientificas, an organisation similar to our own D.S.I.R. Twenty-three countries were represented by a total of about 640 delegates, one of the largest delegations being, as usual, that from the United Kingdom (83). The host country, Spain, had 94 names on the list, and other large delegations were those from France (91), Germany (51), U.S.A. (45), Italy (42) and Sweden (35). The Soviet Union sent 12 delegates, Poland 15 and Czechoslovakia 10.

Council Meeting

All National Committees are entitled to representation on the Council, and the meeting, held on 4th July, was under the chairmanship of Dr. I. Herlitz (Sweden), President of the I.E.C. An application from the Pakistan Standards Institution for membership of the I.E.C. was approved, thus bringing the total membership of the I.E.C. up to 34 countries. The accounts for the year 1958 were presented by the treasurer, Dr. Roth (Switzerland), who pointed out that the surplus on the year's working was 17,000 Swiss francs, as against an estimated surplus of 13,000 francs. This surplus had been made possible through a recent increase in subscriptions from the National Committees, but rapidly rising costs would soon overtake income which during 1958 amounted to 434,000 francs. Of this amount 375,000 francs represented subscriptions from the National Committees, the United Kingdom contribution being 32,400 francs.

The Charles le Maistre Memorial Fund, which is devoted to financing a lecture each year to commemorate the services of international standardisation rendered by Charles le Maistre, former general secretary of the I.E.C., showed a balance of 14,000 francs, which would enable three more lectures to be given.

The accounts having been adopted, Dr. Roth then introduced the budget for 1960, this being presented in two parts dealing with administrative costs and publishing costs, respectively. The publishing side of I.E.C. activity was designed to be self-supporting, but the cost of running the Central Office is continually rising because of the extra load being imposed upon it as the result of increasing activity on the part of Technical Committees. It was estimated that in 1960 some 2,200 working documents would be produced, as against 1,600 in 1958, and nearly 50 publications would have to be " processed " as against 40 in 1958. As foreshadowed at the meeting held in Stockholm last year, an increase in subscriptions from the National Committees was essential, and the treasurer now formally proposed that the subscriptions should go up by one-third and that the new rate should hold for the next three years.

Several members of Council expressed the view that an increase of one-third would not be sufficient to meet the expenditure over the next three years, and an immediate increase of one-half was suggested. It was pointed out, however, that some National Committees had already obtained authority to agree to an increase of one-third, and if this figure was to be increased they would have to seek further authority, which might mean that no increase at all could be levied this year. So it was finally agreed, on the proposal of the United Kingdom delegation, that the subscriptions should be increased by one-third " until further notice," thus enabling a further increase to be proposed in less than three years' time if necessary.

The Council then discussed arrangements for future grouped meetings of I.E.C. Technical Committees, and reaffirmed the acceptance of the invitation from the Indian Standards Institution for the 1960 grouped meeting to be held in New Delhi in November. No decision was reached regarding the meetings to be held in 1961 and 1962, but invitations from Italy, Roumania and Switzerland were received and noted for consideration.

The final decision taken by the Council was to appoint Mr. L. Ruppert as general secretary. Mr. Ruppert has been acting as secretary since the death of Mr. le Maistre in 1953, but for the past few years he had in fact been fulfilling the duties of general secretary, and this recognition of his work was enthusiastically endorsed by the Council.

Committee of Action

Two meetings of the Committee of Action were held in Madrid, under the chairmanship of the president. The United Kingdom is not at present officially represented on the Committee, its nine-year term of office having expired last year, but United Kingdom delegates (Mr. B. H. Leeson, Mr. H. A. R. Binney and Mr. J. F. Stanley) were in attendance as observers.

The president extended a welcome to Prof. Wegelius (Finland), president of the International Organisation for Standardisation (I.S.O.), who spoke appreciatively of the close co-operation between the two bodies. " If the I.E.C. did not exist," he said, " the work of the I.S.O. would be very difficult."

There are now so many I.E.C. committees in a state of activity that difficulty is being experienced in arranging meetings. Obviously all committees cannot meet during the annual " grouped " meeting, and it is necessary for many meetings to be held at other times spread throughout the year. To facilitate such arrangements the British National Committee took the initiative by stating that they

would be prepared to act as hosts to two or three Technical Committees, together with their sub-committees, every year. This example has now been followed by several other countries, notably Belgium, Germany, Italy, Netherlands and Sweden, with the result that the task of the Central Office in finding "homes" for the various committees will be made easier. It is hoped that secretariats of Technical Committees will seek the assistance of the Central Office in settling where meetings shall be held, instead of negotiating direct with prospective National Committees which might be willing to act as hosts.

The chairmen of three Technical Committees having resigned or died (all of them, by a coincidence, being Americans) new chairmen (again Americans) were appointed by the Committee of Action, as follows:— Technical Committee No. 4, Hydraulic Turbines, Prof. L. J. Hooper; Technical Committee No. 19, Internal Combustion Engines, Mr. T. Robie; and Technical Committee No. 40, Components for Electronic Equipment, Mr. L. Podolsky.

Cables and Waveguides

Consideration was next given to a proposal that a new Technical Committee should be set up to deal with cables, wires and waveguides for telecommunication and electronic equipment. Some work under this heading was already in hand, under the ægis of the Technical Committee on electronic components, but as this committee already had a heavy programme of work it was proposed that cables, wires and waveguides should be "hived off" to a separate committee. This was agreed, and it was decided that the actual title of the new committee should be discussed at the first meeting, when particular care should be taken to ensure that it was made clear, from the title and scope, that this committee would not deal with subjects which were within the province of the International Telecommunications Union. Germany will act as Secretariat for the new committee.

Should connectors for radio-frequency cables be regarded as components (and therefore dealt with by Committee No. 40) or as part of a cable (and therefore dealt with by the new committee on cables, wires and waveguides)? There seemed to be no simple answer to this question, so it was decided that for the time being connectors should continue to be handled by Committee No. 40, but that the matter should be reviewed when the new committee became active.

Other new work proposed included the subject of electro-heating. A Technical Committee to deal with this has existed on paper for many years but has never yet become active. Poland recently suggested, however, that the Committee should now start work on standards for construction and for test methods for industrial electric furnaces, including the life testing of elements and the standardisation of wire sizes for heating elements.

In the discussion on this proposal it was pointed out that the International Union for Electro-heat was also interested in the question of standards, and the I.S.O. might also be interested in certain aspects of the work (e.g. wire sizes). It was therefore decided that the Central Office should take the initiative in calling a round-table conference of interested international organisations to consider the field to be covered by the I.E.C. and the best way of starting work. In the latter connection it was suggested that the International Union for Electro-heat might be in a position to draft detailed proposals for standards as a basis for discussion by the I.E.C.

At this point the Committee of Action adjourned, and when it re-assembled on 10th July the president opened the proceedings by proposing the election of General E. E. Wiener (president of the Belgian National Committee) and Prof. de Artigas (of Spain) as honorary presidents of the I.E.C. It was recalled that Prof. de Artigas had been connected with the I.E.C. since 1910 and was therefore the "oldest inhabitant" of the I.E.C. as regards length of service. During this time he had been particularly interested in the work relating to the International Electrotechnical Vocabulary. General Wiener, who first became associated with the I.E.C. in 1946, was in many respects the backbone of the I.E.C., and like Prof. de Artigas, was also closely connected with the work on the Vocabulary.

Safety Rules

The Sub-Committee on Safety Regulations, which had been set up by the Committee of Action three years ago, presented a report in which it was recalled that the work of the sub-committee (of which Mr. Binney, director of the B.S.I., was chairman) had already resulted in agreement on directives to Technical Committees for their guidance in dealing with equipment in which safety features are of particular importance. A priority list of equipment for which I.E.C. recommendations on safety were desired had been drawn up, and arrangements had been made for work to be started on certain items of industrial equipment, e.g. machine tools. The sub-committee now reported that they recommended that the committee be reconstituted as an Advisory Panel to the Committee of Action, having the following functions:—

(i) to promote the desire to urge forward the work on safety clauses by all the appropriate I.E.C. committees;

(ii) to provide, through its Secretariat (Germany) a point of advice and guidance on safety clauses;

(iii) to take the initiative, when this might be necessary, towards the development of recommendations for classes of equipment not yet dealt with by the I.E.C.

This proposal was adopted by the Committee of Action, and it was agreed that the president would appoint the members of the Advisory Panel in their personal capacities from persons of standing in the work of the Committee of Action.

The president said he had invited Mr. Smoes, director of the Belgian Electrotechnical Committee, to accept the chairmanship of the Advisory Panel, and he thanked Mr. Binney for the valuable work he had done as chairman of the (now disbanded) Sub-Committee on Safety Regulations.

Measuring Instruments

The Committee of Action considered the question of the scope of the Technical Committee on electrical measuring instruments, in the light of discussions that had taken place within that committee on the subject of electronic instruments. The immediate point at issue was that signal generators, not strictly speaking being measuring instruments, were nevertheless used in conjunction with measuring instruments, and should therefore be brought within the scope of the same committee. To give effect to this and similar problems, the scope of the committee was amended to the following:—

> "Electrical instruments for measuring electrical quantities (such as indicating, recording, contact instruments, watt-hour meters, etc.) and their accessories. Electronic measuring instruments and other electronic apparatus (having no measuring element) to be used in association with other instruments (valve voltmeters, signal generators, oscilloscopes, etc.) for measuring electrical quantities."

The I.E.C. has issued recommendations for the climatic

and mechanical robustness testing of electronic components (Publication 68), and this has led to a proposal that similar procedures applicable to low-voltage equipment such as switchgear and rotating machinery should be worked out. This proposal formed the subject of informal discussion between the president and the secretariats of various Technical Committees likely to be interested, with the result that the president submitted to the Committee of Action a statement which pointed out that the tests described in Publication 68 were of wider application than would appear from the declared scope of the document, namely components for radio-communication and similar electronic equipment. Consequently, before any new work on climatic testing was started, the attention of interested Technical Committees should be directed to Publication 68 with a request that existing tests should be adopted as closely as possible, no new tests being introduced unless absolutely necessary. At the same time it was appreciated that for certain classes of equipment there was a need for guidance on climatic and durability testing of lower severity than that provided for in Publication 68, and the Technical Committee on electrical accessories should be asked to take this work in hand, making use as far as possible of work of a similar nature already done by the C.E.E.* on the testing of domestic and similar electrical equipment.

The president's statement was endorsed by the Committee of Action, and it was noted that Poland, who originally raised the matter, would place at the disposal of the Committee on electrical accessories the results of work already done in that country.

Another aspect of testing considered by the Committee of Action dealt with standard temperature and humidity conditions. The Technical Committee on electronic components had drafted some proposals, based on Publication 68 but intended for more general application. The Committee of Action decided that these proposals should be written up, by the Central Office, in the form of a report which, after approval by the National Committees, should be published for general guidance.

* International Commission on Rules for the Approval of Electrical Equipment.

Automatic Data Processing

Sweden submitted a memorandum drawing attention to the many different systems for automatic data processing and the numerous types and makes of computers. It was probably premature to standardise computers as such, or their components, but it was suggested that something could and should be done to unify the form in which the computers received their information and presented their results. If standardisation were attempted in this field much of the work would be non-electrical in nature and therefore outside the scope of the I.E.C. Furthermore, other international organisations were also interested in some aspects of the work.

The Committee of Action noted that some work in this field was at present being done in several countries, and the I.E.C. would, in due course, become involved. As a first step it was decided to approach the I.S.O. with a view to the calling jointly by I.E.C. and I.S.O. of a conference of interested international organisations to review the whole field and plan a programme of work on a co-operative basis.

A proposal that the scope of the Technical Committee on insulating oils should be widened to cover the study of test methods for synthetic fluids and gases used as dielectrics was referred to the National Committees for consideration. A similar procedure was adopted regarding a proposal that the I.E.C. should start work on insulated conductors (as distinct from high-voltage mains cables, tests for which are already being dealt with by an existing I.E.C. committee). The views of the National Committees on both these proposals will be considered at a further meeting of the Committee of Action.

AGRICULTURAL SHOWS

A PROMINENT feature of the recent Royal Show at Oxford was "Electricity Farm," a joint exhibit organised by the British Electrical Development Association in conjunction with the Southern Electricity Board. Occupying a position close to the main showground entrance, it served to demonstrate to farmers not only the many operations which can be carried out more efficiently and economically by electricity, but also others which are made possible only by its use. Standard farm buildings housed the various sections, which covered crop conservation and food preservation, pigs and poultry, the dairy, horticulture and the domestic side.

In the grain and grass conservation section a new model of a fully automatic humidity controller suitable for use with electric grain or grass drying equipment was demonstrated. Briefly, this consisted of a drum-type switch controller operated by three specially designed humidistats so that the controller may be used to increase or reduce the heat applied to the air passing through the dryer.

An electrically heated brooder for chicks recently developed by the Eastern Electricity Board was shown. Since the floor acts as a storage heater and uses electricity for only twelve hours a day to maintain the required temperature, the brooder is not affected by short interruptions to the power supply. Another new electric brooder exhibited utilises a heater consisting of a number of blocks of fireclay incorporating electric heating elements. Operated through a time switch, this type is claimed to be ideal for use during off-peak hours. Other displays on the E.D.A. stand included heating and ventilating equipment for pig pens, a fully automatic pig parlour, and, in the dairy section, examples of electrical appliances for refrigerated milk cooling, steam raising and water heating.

The horticultural interests of the British Thomson-Houston Co. are now incorporated in the A.E.I. Motor and Control Gear Division and their display at the Show included various types of grain dryers, hammer mills, corn crushers, a poultry plucking machine, and a milking machine, fitted with the company's motors and control gear, all of which are standard equipment on these products. F.h.p. motors, applicable to small agricultural appliances, were also displayed, in addition to "Pyrobar" electric heaters, and "Pyroflector" infra-red heaters for pig and poultry rearing.

It is well known that the sensitivity of hens to changes in light intensity affects egg production, and artificial lighting schemes are installed to extend daylight hours. Bad weather conditions also affect light intensity and a new scheme has been devised which, by using an A.E.I. daylight-operated photo-electric relay, ensures a certain intensity of light, irrespective of season or weather. In conjunction with a contactor and time switch, the photo-electric relay controls early morning lighting, brightens the daylight periods when necessary, and extends daylight into the evening.

On the stand of Wolseley Engineering, Ltd., the "Bell" fencer was seen working under water, while Curtis, Padwick

and Co., suppliers of the "Koltec" range of fencing units, had on view a dual-purpose fence controller and fox scarer —a standard controller with a neon bulb flashing approximately 50 times a minute.

Kent County

Locally referred to as the miniature "Royal," the Kent County Show was held this year at Mote Park, Maidstone, in brilliant weather which resulted in a near-record attendance, and the quality of the trade stands again reached a high standard. One of the largest was that erected by the South Eastern Electricity Board. Designed by the Board's own staff, it served not only to demonstrate to the farmer the many advantages of the use of electricity on the farm, but also provided all the facilities of the normal electricity showroom.

There was an excellent display of equipment in the dairy farm section where sterilising apparatus, milk coolers and water heaters, etc., were to be seen, while in the crop conservation display multi-purpose crop dryers and an in-sack tunnel dryer attracted a good deal of attention. The interests of the poultry farmer were catered for by a well-arranged exhibit which included a large electric incubator with live chicks.

In the horticultural section a fully equipped greenhouse illustrated how with the aid of electricity plants and cuttings could be speedily propagated and here the opportunity was taken to demonstrate the many items of electrical equipment specially designed for the market gardener, ranging from hedge trimmers, grass cutters, etc., to sterilisers, heaters and soil warming cables.

In the domestic display there were continuous demonstrations of washing machines and other electrically operated laundry equipment, cookers and food mixers and floor cleaning machines. Other main displays were devoted to space heating appliances and refrigerators.

Great Yorkshire

The "Electricity" stand at the Great Yorkshire Show was staged jointly by the Yorkshire and North Eastern Electricity Boards. On the agricultural side the main emphasis was on crop conservation and food preparation. The exhibits included a small "Crittall" bin to which was attached a model of a Matthews & Yates fan and heater and there was also a working model of a "Flexibin" grain drying installation and a platform grain drying unit. A "Typhoon" multi-purpose unit was shown in conjunction with bales of hay arranged for drying by the tunnel method.

In the food preparation section exhibits included a Bentall "Mini-Wizard," a Christy & Norris "Pneugrister," an "Essex" hammer mill, and a Templewood provender press. A 28ft greenhouse in which were demonstrated mist propagation and automatic watering, soil warming and supplementary lighting was a feature of the horticultural section, which also included a soil-warmed and air-heated outdoor frame. Demonstrations of cooking and home laundering were given in the domestic section, where space heating and refrigeration equipment was also on view.

Railway Modernisation to be Accelerated

BENEFITS OF ELECTRIFICATION

THE British Transport Commission, in a report on a reappraisal of the Railway Modernisation Plan published as a White Paper (Cmd. No. 813, H.M. Stationery Office, price 3s), says that the Plan, already ahead of schedule, should be speeded up to improve the railways' financial position as quickly as possible. At the moment the annual investment expenditure is about £180 million and with an acceleration in the pace of modernisation the amount for the remainder of the 1959-63 period is likely to be about £190-£210 million. Subject, necessarily, to the many assumptions inherent in such a forecast, the Commission's gross receipts should more than cover working expenses by 1963, leaving a working surplus at about the end of 1963 which might be put at between £50 million and £100 million. Against this, interest charges would amount to about £85 million. Beyond that time, working surpluses should rise, but might be counterbalanced by rising interest charges, and, to ensure financial stability in the longer term, the financial structure of the British Transport Commission's organisation should receive consideration.

To achieve a more economic scale of operations there is to be a reduction in route mileage of the order of 10 per cent between now and 1963, representing a much greater rate of closure than in the last four years. On balance, however, little change in passenger train-miles is forecast and the Commission has estimated for a growth of 15 per cent in passenger traffic over the five years. Total freight train mileage is expected to fall by 15 per cent.

Steam traction will be eliminated from large areas of the country and electric traction brought into operation on 600 route miles in addition to the 1,000 route miles in service at the beginning of this year; work will also be proceeding on a further 600 to 700 miles. The suburban electrification schemes will be pressed ahead as rapidly as possible, with the aim of completing them earlier than planned. It is hoped to accelerate the electrification of the main line from Euston to Crewe, Liverpool and Manchester by one or two years, though concentrating resources on this project will mean that electrification of the King's Cross to Leeds and York lines will not be undertaken before 1963. The second phase of the Kent Coast electrification to Dover and Ramsgate via Sevenoaks is scheduled for completion in 1961-62. The investment in electrification schemes, including associated rolling stock and engineering work, during the period 1959-63 will amount to some £265 million.

Referring to passenger traffic prospects at a Press conference, Sir Brian Robertson said that the Commission was confident of getting the additional 15 per cent. Provided traffic density was sufficient to justify the capital expenditure involved, electrification gave the best railway service. Electrification projects had without exception produced an increase in traffic: on the North Kent electrified system inaugurated in June some 30 per cent more traffic had been obtained.

Commission's Operations in 1958

The annual report of the British Transport Commission shows that a deficit of £89 million was incurred in 1958, £21 million more than in the previous year. The main reason is stated to have been the loss of freight traffic in consequence of the slump in heavy industrial production; railway freight, in fact, produced £30 million less revenue than in 1957. Another adverse factor was the loss of revenue during and after the London bus strike. A more encouraging feature of the year was the high level of railway passenger traffic. Excluding 1957, when the petrol shortage resulting from the Suez crisis diverted traffic from the roads, more passengers were carried by British Railways last year than at any time since the Commission was established.

The report states that railway modernisation has gone ahead much faster than originally planned. Emphasis is on rationalisation and the development of a more compact network. The number of multiple-unit diesel vehicles has almost doubled since a year ago and this year 388 main-line diesel locomotives are scheduled to be delivered compared with only 83 in 1958.

B.E.A.M.A. Domestic Appliances Division

CONSTITUTION AND AIMS

THE Council of the British Electrical and Allied Manufacturers' Association has set up a separate Domestic Appliances Division to cater for the needs of its members in this field. The Division works under a Domestic Appliances Board with the following membership: Messrs. W. J. Bird (General Electric Co.), chairman, R. Berry (Berry's Electric), S. Broughton (Electrolux), V. Coffee (Tricity Cookers), R. Craig Wood (A.E.I.-Hotpoint), S. L. Pleasance (Electrical Division of Radiation, Ltd.), E. G. Plucknett (Simplex Electric Co.), C. F. P. Richards (Morphy-Richards), S. Roberts (Hoover) and H. C. Timewell (English Electric Co.). Mr. T. Counter is secretary.

The new Division will embrace the following B.E.A.M.A. Sections: *Electric Cleaners and Polishers.*—Chairman, Mr. W. M. Tribute (Hoover); vice-chairman, Mr. C. B. Reynolds (Electrical Division of Radiation, Ltd.). *Electric Cookers.*—Chairman, Mr. H. C. Timewell (English Electric Co.); vice-chairman, Mr. A. S. Oldhams (Electrical Division of Radiation, Ltd.). *Electric Heating and Portable Appliances.*—Chairman, Mr. R. M. Morgan (Morphy-Richards); vice-chairman, Mr. F. H. Shrimpton (A.E.I.-Hotpoint). *Electric Laundry Equipment.*—Chairman, Mr. A. M. Parkinson (English Electric Co.); vice-chairman, Mr. T. E. Trotman (Simplex Electric Co.). *Electric Water Heaters.*—Chairman, Mr. K. R. Taylor (Santon); vice-chairman, Mr. G. A. J. Housden (Simplex Electric Co.).

A further Section relating to Electric Pads and Blankets will shortly be set up and arrangements for co-operation with the domestic electric refrigerator manufacturers are being actively considered.

The offices of the new Division are at Regent House, 89, Kingsway, London, W.C.2 (telephone: Holborn 0502).

Message from the Chairman

Mr. J. W. Bird, chairman of the Divisional Board, has given us the following message:—

The new Domestic Appliances Division of B.E.A.M.A. has as its aims and objects the following:

"To promote the interests and progress of the British domestic electrical appliances manufacturing industry and to provide a forum for the discussion of all matters affecting the industry both at home and overseas."

A Divisional Board has been set up of which I have the honour to be the first chairman. This Board is composed of the heads of the larger manufacturing interests in the industry, but let me say straight away that this does not mean that the smaller manufacturers' interests will be neglected or ignored in any way. Each member of the Board brings to the task ahead a wide fund of experience in many fields, and it is their purpose to create a bigger and better industry for all.

Discussions will take place, as soon as they can be conveniently arranged, with many sections of the distributive trade, since it is the view of the Division that the prosperity of the distributive trades is of equal importance to the prosperity of the manufacturers. It is only on this basis that manufacturers will be able to have their products properly presented and actively promoted to the purchasing public.

Nothing in the purpose of the Division, or its activities, could in any way be construed as restrictive; it has an expansionist policy. There will be no question of price agreements, but I have the hope there will be adherence to sensible trading practices by common understanding and goodwill. A prosperous and expanding home market is essential as the base for an aggressive and expanding export trade in the national interest.

The Board of the Division is united in its sense of purpose, and in my view, with the active co-operation of all concerned, it will become a major force in the electrical industry, and indeed in the affairs of the nation. In due time it will receive recognition which will enable it to impress upon the Government of the day the importance of the domestic electrical equipment industry and to seek the Government's co-operation to achieve the maximum results for the national economy.

I regard it as a privilege to have a part to play in this enterprise, and my colleagues on the Board are confident that the various sections which have been set up, and their individual chairmen and vice-chairmen, with the help of the Board and the B.E.A.M.A. directorate and staff will do a good job.

A welcome to the appropriate section awaits any manufacturer of repute who cares to make application for membership of the Division and in any case it is hoped that all manufacturers will co-operate in the production of statistics vital to our successful operation.

Collecting Statistics

As we announced in our issue of 15th May, the B.E.A.M.A. has undertaken the responsibility, on behalf of the whole domestic electrical appliance industry, for the collection and dissemination of statistics of the production of individual domestic electrical appliances. These statistics are no longer being collected by the Board of Trade and unless the B.E.A.M.A. scheme is well supported figures will not in future be available in sufficient detail to be useful to industry. The full cost of the scheme will be borne by the Association.

To ensure secrecy manufacturers will make their returns direct to a firm of accountants and only the totals will be passed to the B.E.A.M.A. for release. The aim is to provide the contributing firms with the fullest possible detail consistent with avoiding the risk of disclosure of an individual manufacturer's business; less detailed information will be published at possibly quarterly intervals. In addition to the figures previously published by the Board of Trade, the B.E.A.M.A. is to collect details of the production of spin dryers, and there will be separate figures for washing machines that incorporate a spin dryer. Another innovation will be the listing of fires under five headings.

Manufacturers who have not yet been approached are asked to write to Price Waterhouse & Co., 3, Fredericks Place, London, E.C.2, for forms and an explanation of the scheme.

The First Atlantic Cable

A MONOGRAPH prepared by Bern Dibner and published by the Burndy Library, Norwalk, Connecticut, U.S.A. (96 pp.; price $2.50), gives an account of the early endeavours to lay a transatlantic telegraph cable, including the satisfactory but short-lived attempt by C. W. Field in 1858 and the more successful expeditions in 1865-66. Although the book pays tribute to Field's ability in carrying the project through to a successful conclusion after 13 years, it also stresses that the cables were a combined effort. A leading role was played by Professor S. F. B. Morse, while Professor William Thomson, later Lord Kelvin, was even more active, accompanying each of the five expeditions from 1857 to 1866. The cable also utilised basic research by Michael Faraday, who had investigated capacitance and inductance effects in long underwater cables. The book, "The Atlantic Cable," has 54 contemporary illustrations and two appendices giving correspondence of both Morse and Dr. E. O. W. Whitehouse.

A.E.I. Reorganisation

SEVEN new product divisions of Associated Electrical Industries, Ltd., began trading on 1st July. They are the Motor and Control Gear; Switchgear; Transformer; Electronic Apparatus; Traction; S.E.S. Cables; and S.E.S. Telecommunications Divisions. The Turbine Generator and Heavy Plant Divisions were formed a year ago and further divisions will begin trading shortly.

A new company, Associated Electrical Industries Export, Ltd., has taken over from the separate export companies of British Thomson-Houston, Metropolitan-Vickers and Siemens Edison Swan, and is now responsible for the overseas selling organisation for these companies and the product divisions. Of the nine area managers appointed, two deal solely with the products of Siemens Edison Swan. In Canada a new A.E.I. company has been formed to take over the selling activities previously conducted there by the three individual subsidiary companies, and similar A.E.I. companies are being formed in New Zealand, South and Central Africa, and Brazil. In the United Kingdom twenty-three A.E.I. district offices have replaced the branch offices of British Thomson-Houston, Metropolitan-Vickers and Ferguson Pailin, and they are controlled by seven regional managers.

This reorganisation of the A.E.I.'s selling organisation at home and abroad was described by Lord Chandos as the logical outcome of the removal of competition within the group. Its main purpose was the need to meet the "intensely competitive conditions within the electrical industry." On the export side, Lord Chandos thought the new organisation might make it possible for them to break into new markets.

Though there is some reticence on this point, it would appear that the names B.T.H. and Metropolitan-Vickers will gradually disappear from the products of the division they control; the name Siemens Edison Swan may be retained somewhat longer. The A.E.I. Lamp & Lighting Co., Ltd., and A.E.I.-Hotpoint, Ltd. (with its export company, A.E.I.-Gala, Ltd.), remain unchanged.

Personal appointments to the new companies and divisions are as follows:

Associated Electrical Industries Export, Ltd.—Chairman, Mr. E. H. Ball; joint managing directors, Messrs. B. A. Hensler, F. R. Mason and E. V. Small; directors, Dr. J. N. Aldington, Messrs. J. B. Baldwin, H. F. Bibby (director, administration), R. L. Chantrill (director, technical), Dr. C. Dannatt, Messrs. G. H. Jolley, D. R. Love and H. E. Wethered; secretary, Mr. A. R. Laing. *Area Managers*:—European Area, Mr. W. C. Scott; Middle East Area, Mr. E. C. Whiteley; African Area, Mr. A. W. Barford; Eastern Area, Mr. W. A. Hardman; Australasian and New Zealand Area, Mr. P. J. Tyrrell; North American Area, Mr. F. C. Gray; Latin American and Caribbean Area, Mr. C. H. de Nordwall; S.E.S. Eastern Area, Mr. P. R. Watson; and S.E.S. Western Area, Mr. T. S. Sprake. *A.E.I. Canadian Company*:—President, Mr. H. G. McHaffie; directors, Messrs. R. P. Horlock, H. T. Wormell, F. R. Mason, E. V. Small and B. A. Hensler.

Home District Offices.—General manager, Mr. W. A. Ankerson; district office executive (Manchester), Mr. R. S. D. Bagnall; and district office executive (Rugby), Mr. K. G. Leach. *Regional Managers*:—Scottish, Mr. L. Whitham; North Western, Mr. A. C. Ellis; Northern, Mr. A. J. Crawford; North Midlands, Mr. W. J. Wilson; Midlands, Mr. K. J. Clarke; South Western, Mr. J. S. Hall; and Southern, Mr. E. Mead.

Product Divisions.—*Electronic Apparatus*:—General manager, Mr. E. Alexander; commercial manager, Mr. V. M. Roberts; manufacturing manager, Mr. E. T. W. Barnes; chief engineer, Mr. A. L. Whiteley; and divisional executive (Manchester), Mr. A. G. Barton. *Motor and Control Gear*:—General manager, Mr. J. G. Boddy; commercial manager, Mr. R. G. A. Dimmick; manufacturing manager, Mr. A. G. W. Cannon; chief engineer, Mr. A. G. Williamson; and divisional executive (Manchester), Mr. W. Hall. *Switchgear*:—General manager, Mr. J. R. Wilkinson; commercial manager, Mr. J. C. Dawson; manufacturing manager, Mr. R. Clough; chief engineer, Mr. C. F. Humphreys. *Transformer*:—General manager, Mr. C. P. Holder; commercial manager, Mr. J. Dyson; manufacturing manager, Mr. A. Jones; chief engineer, Mr. L. C. Richards; and divisional executive (Rugby), Mr. D. N. Relf. *Traction*:—General manager, Mr. F. Whyman; commercial manager, Mr. W. B. G. Collis; manufacturing manager, Mr. R. P. Knight; chief engineer, Mr. G. R. Higgs; and divisional executive (Rugby), Mr. J. H. Cansdale.

Boilermakers' Agreement Upheld

THE restriction in the agreement between members of the Water-Tube Boilermakers' Association has been found to be not contrary to the public interest. This, the first favourable decision of the Restrictive Practices Court, was announced in a reserved judgment on 31st July following a twelve-day hearing earlier in the month. Mr. Justice Upjohn declared that the abolition of the scheme, operated in the way it was in relation to overseas orders, would be likely to cause a substantial reduction in the volume of earnings of the export business compared to the total of the whole business. Though members might tender somewhat higher prices if the restriction were not abolished, the Court did not think that any detriment to the public (in this case the purchasers and users of boilers) outweighed the national benefit resulting from the exports they expected if the scheme continued.

The main provision of the agreement enables a "selected member" to reduce his price to the lowest evaluated price tabled at a meeting of members. The other members may not reduce their tabled prices.

The Court was satisfied that the Association's scheme was so operated that it did not result in inflated prices being quoted, but competitive prices which included only a low but reasonable margin of profit, and on the other hand, did not result in "slashed" or uneconomic prices being tabled. Without such a scheme prices would fall to a wholly uneconomic level.

The Court was, however, unable to accept the Association's arguments that the agreement was necessary to retain key personnel during a period of recession, such as the industry was now experiencing; and that without the scheme the collective research department would close down and that quality would suffer. It was of the opinion that the Association had entirely failed to prove that abrogation of the agreement would deny to the public any benefits. The Court agreed that the Central Electricity Generating Board was properly described as a preponderant buyer but held that the Association's scheme was unnecessarily wide to satisfy the section of the Act (21(1)d) which covered this point.

Commenting on the decision, the chairman of the Water-Tube Boilermakers' Association, Mr. J. B. Woodeson, said: "The Court has shown a realistic appreciation of the national importance of this great industry and in particular of its achievements in the field of overseas trade. The overriding concern of the Association is to give the maximum service to its customers throughout the world, and the Court, by its judgment, has ensured that there will be no deterioration in the standards which the industry has set itself."

Railway Electrification Conference

ARRANGEMENTS are being made for the holding of a Railway Electrification Conference and Exhibition from 3rd to 7th October next year. In this the British Transport Commission is being joined by the British Electrical and Allied Manufacturers' Association and the Locomotive and Allied Manufacturers' Association of Great Britain. The theme of the exhibition will be "Developments in A.C. Electrification, including the Supply Aspect."

OVERSEAS ELECTRICAL TRADE

A GOOD SIX MONTHS

DURING the first six months of this year British electrical manufacturers exported goods worth £116 million. This compares with the £111 million worth of electrical goods exported during each of the two halves of 1958. Despite a steady fall in the monthly totals of electrical exports (from £22·6 million in April to £21 million in May and to £17 million in June) the total of £61 million achieved in the second quarter of 1959 was 9 per cent higher than that recorded for the first quarter and 5 per cent higher than that for the last quarter of 1958.

The monthly trade figures have always been subject to considerable fluctuations over and above those attributable to the different lengths of months, holidays and seasonal factors. During the past year or so this "random" element appears to have been more pronounced. It is probably due in part to variations in the

TABLE I.—ELECTRICAL EXPORTS

Class	Month of June, 1959	Six months ended 30th June, 1958	Six months ended 30th June, 1959
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	94,833	757,887	610,377
Ditto, 10 to 65 kW	162,431	1,126,180	866,424
Ditto, 65 to 200 kW	146,608	1,113,254	992,162
Ditto, over 200 kW	407,693	2,332,221	1,835,522
Spark ignition engine driven	8,593	94,500	70,310
Steam turbine driven	52,276	428 078	512,929
Hydraulic turbine driven	—	—	—
Other prime mover driven	78,676	76,165	213,564
Generators, not exceeding 200 kW	101,948	780,682	588,139
Ditto, over 200 kW	78,651	592,706	589,790
Parts of generators	416,477	4,747,718	3,599,966
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ¼ h.p.	167,568	925,256	930,414
Over ¼ but under 1 h.p.	37,434	319,051	278,058
1 h.p. to 250 h.p.	355,002	2,876,306	2,631,992
Over 250 h.p.	176,447	662,514	1,022,003
Railway, tramway and trolley-bus motors complete and parts of all motors	405,071	1,354,672	1,562,508
Motor starting and controlling gear	340,385	1,544,791	2,052,713
	3,030,093	19,731,981	18,356,871
Converting machinery	89,636	206,258	327,372
Mercury-arc rectifiers	71,085	611,477	325,564
Transformers for lighting, heating and power (incl. coils):			
Not exceeding 7,500 kVA	372,540	3,875,542	3,061,340
Over 7,500 kVA	403,305	2,531,634	2,561,609
Switchgear and switchboards (not telegraph or telephone), up to 200 A and 660 V	273,430	2,425,388	2,144,110
Ditto, other	1,307,630	6,031,972	7,471,410
	2,517,626	15,682,271	15,894,404
Primary batteries:			
Lighting	86,541	509,094	602,990
Radio	285,285	1,747,863	2,073,784
Other	28,070	261,557	217,358
Parts (excl. carbons)	39,067	283,588	267,902
Lamps:			
Filament, exceeding 28 V	85,168	504,116	529,188
Ditto, under 28 V	20,602	165,864	176,826
Arc lamps and searchlights	7,049	113,894	98,421
Discharge lamps, fluorescent tubes, etc.	77,908	487,253	565,135
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury-arc rectifiers), photo-electric cells, stabilising and cold cathode valves, magnetrons, klystrons	36,112	159,245	251,018
All other	372,199	2,011,290	3,050,765
Parts (excluding glass bulbs)	20,771	98,270	163,435
Radio and television transmitters	58,858	226,442	606,291
Commercial radio and radar equipment	1,046,667	6,927,888	9,257,514
Domestic radio receivers, mains	52,415	490,428	577,563
Ditto, battery	55,389	318,609	340,395
Ditto, other (incl. car)	30,422	131,887	183,869
Radiograms	28,359	195,945	159,813
Television sets	47,118	654,783	389,590
Public address equipment	92,951	586,507	578,568
Other radio and television apparatus, n.e.s.	143,422	191,116	440,475
Components and parts, n.e.s.	677,444	4,423,315	4,656,583
	2,662,127	16,415,725	20,655,879
Telegraph and telephone installations	772,455	4,564,451	4,528,973
Telephone instruments, separately consigned	80,119	1,111,468	607,783
Telegraph and telephone parts	704,072	4,306,501	4,792,215
Line apparatus for long distance communication	187,326	1,007,566	1,239,555
	1,743,972	10,989,986	11,168,526

Class	Month of June, 1959	Six months ended 30th June, 1958	Six months ended 30th June, 1959
	£	£	£
Cookers	34,607	332,955	219,991
Toasters	12,521	118,279	103,177
Other cooking apparatus	27,903	207,184	196,277
Parts and accessories	102,195	320,530	521,322
Space heating appliances	30,084	206,711	144,685
Water heating appliances	26,935	166,881	172,220
Other heating appliances	22,917	213,652	150,144
Parts and accessories	65,111	377,004	445,584
Irons	64,070	442,057	400,251
Arc welding equipment, a.c.	35,360	390,016	251,325
Ditto, d.c.	25,927	434,991	330,720
Resistance welding equipment	25,362	80,192	221,922
Electric furnace plant	39,207	501,491	414,035
Magnetos, ignition	20,620	91,857	79,231
Sparking plugs	148,982	851,985	919,514
Elec. appliances for aeroplanes, n.e.s.	333,615	1,586,007	1,976,109
Ditto, for motor vehicles, n.e.s.	340,027	2,312,386	2,392,769
Ditto, for cycles, n.e.s.	39,089	311,414	238,210
Signalling app. (incl. traffic signals)	311,648	863,396	1,369,428
Instruments, commercial	157,641	1,075,047	1,062,593
House service meters (including parts)	130,726	879,512	772,007
Electro-medical apparatus (not X-ray)	27,576	295,977	181,978
X-ray apparatus (excl. tubes and valves)	71,381	333,098	258,910
Ceiling fans, complete	111,714	641,960	579,308
Desk fans, complete and parts of desk and ceiling fans	18,315	148,743	95,610
Vacuum cleaners	130,830	785,624	835,427
Floor polishers	70,741	385,260	445,148
Food mixers	46,358	321,449	453,410
Hair clippers and dry shavers	46,671	319,369	223,920
Other portable appliances	20,365	108,905	131,140
Parts	118,330	645,376	679,281
Portable elec. tools (not saws) and parts	171,763	1,285,474	1,186,431
Cables and wires:			
Telegraph and telephone, submarine	37,143	425,639	3,119,788
Ditto, other	362,697	3,295,465	2,559,497
Cotton, silk or art. silk insulated	21,161	275,898	117 981
Enamel, glass or asbestos insulated	84,709	480,189	549,945
Paper insulated	489,381	4,406,336	3,679,398
Rubber insulated	276,041	2,870,639	1,767,251
Thermoplastic insulated	252,991	1,178,470	1,428,558
Other	112,308	1,383,375	1,001,591
	1,636,431	14,316,011	14,224,009
Accumulators for motor vehicles	123,168	964,247	876,291
Ditto, traction	34,795	128,823	133,281
Ditto, radio and other portable	46,708	323,182	182,600
Ditto, other	42,172	157,933	354,005
Parts and accessories	70,921	637,970	489,892
Electric wiring accessories	164,007	958,119	1,171,752
Elec. ceramic ware, etc. (incl. insulators), n.e.s.	92,757	612,257	644,771
Insulating cloth and tape	54,514	283,345	319,847
Other insulating material	149,713	564,691	852,531
Permanent magnets	47,048	296,267	268,189
Radio, telegraph and telephone testing equip., n.e.s.	108,795	379,024	770,559
Scientific elec. instruments (excl. telegraphic or telephonic, time recorders and time switches)	337,964	182,111	1,980,764
Electrical machinery, n.e.s.	25,602	444,475	185,841
Electrical apparatus and appliances, n.e.s.	917,235	5,055,174	5,923,585
TOTAL	17,263,929	111,638,225	116,437,278

Note.—Because of the delay in publication of the "Trade and Navigation Accounts" for June, last year's unadjusted figures have been used for 1958 in the tables.

TABLE 2.—DISTRIBUTION OF EXPORTS (TABLE 1)

Country	Month of June 1959	Six months ended 30th June 1958	Six months ended 30th June 1959
	£	£	£
Gibraltar	14,503	199,198	64,211
Malta and Gozo	23,269	441,174	253,304
Cyprus	62,120	494,250	386,515
Sierra Leone	40,498	348,501	213,246
Ghana	245,451	965,753	1,251,645
Nigeria	396,862	2,191,596	2,826,353
Union of South Africa	1,670,111	9,789,478	9,964,003
Rhodesia and Nyasaland	665,885	2,655,960	3,724,721
Tanganyika	53,044	291,251	250,499
Kenya	188,830	798,481	995,611
Uganda	33,626	383,781	296,175
Mauritius	38,590	249,494	314,396
Aden	32,231	330,832	322,525
Bahrain, Qatar and Trucial States	142,268	516,714	640,455
Kuwait	175,632	947,413	1,158,739
India	1,271,015	9,261,517	9,599,352
Pakistan	263,049	1,411,507	1,628,467
Singapore	277,048	1,903,582	1,572,472
Federation of Malaya	158,960	1,659,333	1,496,093
Ceylon	264,436	904,268	1,230,755
British North Borneo	11,430	117,761	172,798
Sarawak	12,172	126,868	99,223
Hong Kong	356,309	1,731,507	2,497,570
Australia	1,391,724	9,332,633	8,460,005
New Zealand	490,326	6,882,502	4,759,007
Fiji	16,832	124,636	182,671
Canada	948,544	7,866,154	5,799,064
Jamaica	154,940	808,489	956,915
Barbados	39,756	150,840	215,404
Trinidad	139,099	697,016	729,732
British Guiana	32,767	458,568	411,832
Other Commonwealth countries	196,249	969,378	1,292,678
Irish Republic	226,677	1,637,295	1,694,442
Soviet Union	219,083	248,617	732,194
Finland	87,956	767,159	584,096
Sweden	354,262	2,784,593	2,997,348
Norway	137,822	1,242,492	1,069,450
Denmark	217,073	1,143,806	1,319,516
Poland	164,910	433,619	373,387
Western Germany	345,503	1,590,703	3,167,362
Netherlands	498,478	3,588,872	3,836,231
Belgium	272,759	1,701,069	1,941,090
France	190,545	2,062,094	1,538,107
Switzerland	161,466	913,758	1,002,378
Portugal	185,053	1,943,632	1,364,856
Spain	59,000	1,030,086	986,547
Italy	235,029	1,679,528	1,822,820
Austria	37,457	256,438	261,782
Yugoslavia	33,754	292,332	436,991
Greece	84,169	511,516	686,888
Turkey	40,880	695,805	400,696
Belgian Congo	52,155	211,379	281,630
Portuguese East Africa	14,769	145,020	129,080
Egypt	141,490	619,168	1,069,143
Libya	52,557	326,355	442,615
Morocco (excluding Tangier)	26,434	185,985	213,379
Sudan	99,822	554,557	570,692
Syria	10,996	136,732	121,731
Lebanon	52,104	324,236	302,713
Israel	155,791	553,179	716,671
Jordan	21,539	452,517	502,599
Saudi Arabia	87,814	490,099	373,157
Iraq	145,610	1,744,615	1,882,973
Iran	199,204	2,112,116	1,883,302
Burma	105,659	404,726	574,109
Thailand	57,368	841,798	573,493
Indonesia	42,186	176,974	199,027
Japan	51,448	311,026	358,213
United States of America	1,026,952	3,778,675	8,286,258
Cuba	69,000	486,299	218,879
Mexico	59,248	297,743	238,628
Colombia	23,528	245,258	191,302
Venezuela	585,663	2,127,795	2,281,532
Peru	34,874	205,878	144,848
Chile	41,735	222,749	667,505
Brazil	30,133	614,943	478,053
Uruguay	5,022	15,269	55,348
Argentine Republic	426,197	1,868,813	1,245,872
Other foreign countries	285,179	1,969,655	2,551,909
TOTAL	17,263,927	111,638,225	116,437,278

TABLE 3.—SOURCES OF ELECTRICAL IMPORTS

Country	Month of June 1959	Six months ended 30th June 1958	Six months ended 30th June 1959
	£	£	£
Australia	17,016	294,095	204,903
Canada	94,008	523,873	453,749
Other Commonwealth countries	197,699	677,642	734,596
Irish Republic	105,843	439,548	489,198
Sweden	115,186	589,838	670,978
Denmark	63,791	251,505	303,447
Western Germany	649,203	2,640,086	3,397,849
Netherlands	560,276	2,106,673	2,881,735
Belgium	50,580	282,703	274,961
France	197,142	676,675	843,009
Switzerland	233,474	615,715	857,325
Italy	76,267	396,833	496,100
United States	915,146	3,814,151	5,074,824
Other foreign countries	164,433	703,546	1,269,231
TOTAL	3,440,064	14,012,883	17,951,903

arrival and departures of ships and there is a tendency for the fluctuations to be compensated for in other months. But even when allowance is made for the exceptional shipment of £3 million worth of submarine cable to the United States in April, the figure for the second quarter was still 4 per cent higher than that for the first three months.

There was an increase of over £4 million in the exports of radio and electronic apparatus during the first half of this year compared with the first half of 1958 and smaller increases in exports of telegraph and telephone apparatus, transformers and switchgear. Exports of generators and motors and of cables were below the level of last year. The largest markets were South Africa, India, Australia and the United States. The importance of the United States is indicated by its position as the largest market for cables, the second largest market for generators and motors, and the third largest for radio and electronic equipment. During the first half-year exports to the United States were almost equal to the level achieved during the whole of 1958. Exports to Canada were lower than a year ago. Compared with the first half of 1958, there was an increase in exports to most Western European countries, those to Western Germany being nearly double.

Electrical imports in the second quarter of this year were £9·8 million compared with £8·2 million in the first quarter and £8·4 million in the fourth quarter of 1958. The six months' total of imports was £18 million compared with £14 million in the first six months of 1958.

TABLE 4.—OTHER ELECTRICAL AND ALLIED EXPORTS

Class	Month of June 1959	Six months ended 30th June 1958	Six months ended 30th June 1959
	£	£	£
Washing machines, electrically operated:			
Not exceeding 150 lb weight	256,381	2,396,084	1,742,944
150 lb to 250 lb	56,562	485,904	288,524
Parts	73,769	431,092	469,976
Electric locomotives (incl. battery types)	616,249	1,538,597	3,023,668
Diesel locomotives with electrical transmission	750,874	965,562	1,876,429
Welding electrodes:			
Ferrous	81,826	541,544	492,200
Non-ferrous	21,320	180,077	126,641
Electric conduit tubes and cased tubes	56,548	351,759	359,487
Electric carbons	97,884	312,511	596,672
Electric lighting fittings and lanterns (excl. arc lamps, searchlights and cycle lamps)	275,167	1,684,407	1,740,002
Electric fork-lift trucks	55,041	355,842	483,928
Steam turbines	694,319	3,559,337	5,856,934
Water turbines	292,204	1,347,292	1,865,621

TABLE 5.—ELECTRICAL IMPORTS

Class	Month of June 1959	Six months ended 30th June 1958	Six months ended 30th June 1959
	£	£	£
Generators, incl. parts	75,567	396,089	395,046
Motors, incl. parts	127,792	547,479	715,059
Convertors; transformers; rectifiers	98,137	164,155	559,437
Switchgear and switchboards (not telegraph and telephone)	97,442	290,767	546,019
Cathode ray tubes, complete	169,372	968,830	592,709
Other valves, complete	261,738	339,487	1,410,994
Parts (excl. glass bulbs)	57,841	194,802	358,155
Radio receiving sets, domestic or portable	36,033	66,493	122,103
Radio communication and navigational aids, complete	535,102	1,740,983	2,205,841
Other radio and TV apparatus, parts and accessories	358,871	1,964,392	1,927,553
Apparatus for telegraphy and telephony	124,666	532,512	603,710
Welding machinery	70,626	173,213	305,609
Cooking and heating apparatus	66,292	766,172	844,343
Magnetos, ignition, and electric appliances for aeroplanes, motor vehicles and cycles	177,036	1,251,149	973,534
Electro-medical apparatus (incl. X-ray apparatus)	80,932	483,126	489,929
Portable mechanical appliances, electrically operated, complete	106,906	481,821	631,702
Parts	33,648	359,578	320,852
Scientific electrical instruments (excl. telegraphic and telephonic)	180,008	865,485	834,545
Other machinery, apparatus and appliances	782,175	2,426,350	4,114,763
TOTAL	3,440,064	14,012,883	17,951,903

NEW ELECTRICAL EQUIPMENT

Change-Over Relay

A general purpose relay suitable for switching up to 15 A at 415 V a.c., provided with three change-over contacts and mounted on a bakelite base-plate with screw terminal connections, has been introduced by CONSTANT CONTROLS, LTD., 103, Berrylands, Surbiton Hill, Surrey.

The standard ¼in diameter contacts are of pure silver, but other types can be supplied to order, and the operating coils can be wound for any specified voltage up to 400 V a.c. All coils are continuously rated. The coil assembly comprises a solid fully shaded pole piece with a hinged armature providing equal pressure on both "make" and "break" contacts.

All components of the relay, which complies with B.S. 755, are suitable for normal temperature and humidity, and tropically finished relays can be supplied if required.

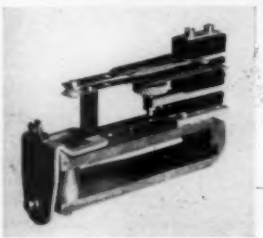
Busbar Relays

Relays providing an indication of heavy currents flowing in a d.c. system busbar—for example, welding currents—and which can also be used as overload devices to trip at a preset figure, have been announced by LONDEX, LTD., Anerley Works, 207, Anerley Road, London, S.E.20. No conventional coil is employed but a yoke of a material avoiding residual magnetism is clamped around the conductor. Each relay is provided with one set of normally open 6 mm silver contacts rated for 4 A at 250 V a.c., an adjusting screw enabling the operating figure to be set within the ranges quoted for each type. A 2,000 V insulation test is applied between the contacts and the relay frame.

The type BZ/SQ relay has a yoke for clamping to rectangular section conductors not exceeding 2in by ½in, and five models are available to cover ranges from 100 to 1,100 A d.c. The type BZ/R relay is designed for use with circular conductors, busbars or insulated cables up to ¾in diameter. Three models are available covering ranges from 70 to 400 A d.c. Both types of relay are available, if required, with a pneumatic damper to provide approximately a half-second delay in operation so that high transient currents do not cause the relay to operate.

A polarised d.c. busbar relay for operation on reverse currents only, capable of withstanding sustained forward and reverse currents of up to 20,000 A, is also available.

Londex busbar relay



Transistor Power Packs

The lightweight transistorised d.c. to a.c. convertors and invertors which have been developed by ELECTRODEVICES, LTD., 12, Penzance Place, Kensington, London, W.11, have an efficiency of the order of 75 to 85 per cent. The power packs can replace rotary convertors and invertors or mechanical vibrator units where low weight and high efficiency are essential. Typical applications are power supplies for mobile transmitter/receivers, supplying mains operated equipment from low voltage d.c. sources, and transport applications at sea and in the air where reliability and a low power/weight ratio are essential.

Electrodevices power pack

The power packs are, at present, available as 30 W, 60 W and 120 W units operating from 6 V d.c. upwards. Units can be supplied, however, to suit special requirements.

Stud Welder

Stud welding equipment for use with standard arc welding transformers and mild steel studs of $\frac{3}{16}$ to ¾in diameter and up to 3¾in long has been introduced by the STUD WELDING APPLICATIONS CO., Roads Estate, 301, Richmond Road, Twickenham, Middlesex. The controls for the equipment are contained in a steel case measuring 12 by 12 by 8in; the weight is 32 lb. The control unit, which operates from 200/240 V or 380/440 V a.c. 50 c/s supplies, can, when installed on the primary side of the welding transformer, be left in situ and used for either arc or stud welding merely by operation of a selector switch.

The pistol-type hand tool, which is designed for use with Philips' stud welding cartridges, weighs only 2½ lb and has an overall length of 8¼in when welding 1in-long studs. The body is an aluminium-alloy casting which is completely insulated, and the trigger voltage is 12 V. In the butt of the casting is a locking screw adjustment which controls spring pressures suitable for all positional welding. The price of the complete equipment is £104 10s, and the initial delivery is four to six weeks.

Induction Heaters

The Model E 9/12 induction heater manufactured by DELAPENA & SON, LTD., Tewkesbury Road, Cheltenham, Glos., previously available as a single model, has now been replaced by three models of the same power output but having different characteristics, making each suitable for a particular class of work. The new models, known as the E 9/12 HC, E 9/12 LC and E 9/12 H, are generally similar in design but differ in the impedance characteristics of the r.f. circuits and in the provision, on two models, of an additional power control. Each model has a maximum continuous power output, to B.S. 1799 : 52, of 9 kW and an intermittent rating allowing operation at an output of up to 12 kW provided the average power output does not exceed 9 kW.

Models HC and LC are fitted with an on-load output current control allowing continuous fine regulation of the power output, over a ratio of 10 : 1, during the heating cycle by varying the ratio of the r.f. output transformer. The standard output current control is manually operated, but automatic operation can readily be incorporated

Delapena model E 9/12 HC induction heater

where the set is to be used in fully automatic production lines or to meet other special requirements. Model H is a high-impedance set, not fitted with an output current control, for heating non-ferrous metals—or ferrous metals below about 770 deg C—in any application within its power range requiring the use of a r.f. transformer or other high-impedance loads, for example for soldering or brazing applications.

Flameproof Circuit-Breaker

The type SBU.1 hand-operated air-break circuit-breaker designed by the BELMOS CO., LTD., Bellshill, Lanarkshire, in accordance with N.C.B. Specification P 7/1950, which is certified as flameproof for Group I gases, is housed in a welded steel case divided horizontally into two flameproof compartments.

The upper compartment contains a triple-pole on/off/earth isolator mechanically interlocked with the door of the main compartment. When the isolator is in the earth position, the outgoing circuit is earthed whether or not the breaker is closed. The circuit-breaker and its protective gear are housed in the lower compartment and mounted on a withdrawable chassis. Main connections between the chassis

Belmos flameproof circuit-breaker

and housing are made by spring-loaded sliding contacts between the compartment roof and the chassis, while auxiliary connections are made through four pairs of spring-loaded butt contacts situated at the rear of the chassis.

Continuously rated at 200 A, the breaker has been tested in accordance with B.S. 936 : 1940. It has a breaking capacity of 9,000 A at 650 V, 0·25 power factor, equivalent to 10 MVA, and a making capacity of 21,200 A peak at 650 V. Overload protection is provided by a two-pole self-resetting solenoid relay, with two-rate time delay. An under-voltage relay is fitted which trips the breaker when the supply voltage falls below 66 per cent of the declared value. Earth leakage protection is provided by a d.c. relay energised from a ring-type transformer through a full-wave rectifier. Remote tripping and electrical interlocking can also be provided by a control circuit incorporating pilot-earth fault protection. The breaker can be fitted with an outgoing cableway or alternatively, when coupled to a bank of units, it can be used as a section switch controlling the supply to the through-going busbars.

Forthcoming Events

The Association of Short-Circuit Testing Authorities is to hold a dinner on 9th December next to celebrate the twenty-first anniversary of its incorporation. Details will be announced later.

The Southern Centre of the Institution of Electrical Engineers is holding a dinner and dance on 8th April next year at the Bedford Hotel, Brighton. This is additional to the official Centre dinner and dance which is normally held at Southampton in December.

Flash Annealing Furnace

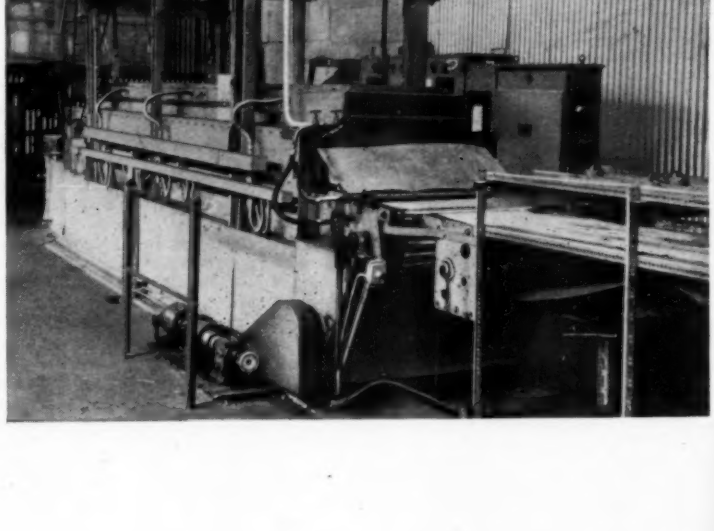
A continuous flash annealing furnace in which circles of aluminium manganese alloy are heated rapidly by radiation, to produce the fine grain structure needed for deep drawing, is being operated by the Aluminium Corporation, Ltd., at their Dolgarrog works in North Wales. The furnace was designed and manufactured by Royce Electric Furnaces, Ltd., in conjunction with the company. Heating panels fitted with heavy gauge nickel-chrome elements are positioned in the furnace roof and hearth, and variations in heating rates are made by adjusting the spacing of the panels from the work, the roof and hearth panels being built as separate units moved by synchronously driven jacks. Vertical sliding doors at the furnace ends allow the entrance and exit to the heating chamber to be closed to reduce heat losses.

The charge is carried through the furnace on a horizontal conveyor which has two endless chains carrying cross flights of heat-resisting steel, covered with woven asbestos cloth to provide a non-abrasive support. The conveyor is driven by a squirrel cage motor through a reduction gear, and its speed can be varied between 4 and 30ft per minute.

The heating elements are supported in grooved refractories of high density which serve as a heat reservoir. The temperature of the furnace is controlled in four independent zones, the automatic indicating controllers being used not to switch the element supply but to regulate the supply voltage. The conveyor temperature is maintained by the provision of a closed and heat-insulated return path. Safety precautions are incorporated to protect the elements from damage by overheating and to protect a charge should the conveyor be stopped accidentally.

The furnace, which has a rating of 90 kW, provides temperatures up to 900 deg C and has a heating chamber 21in wide by 15ft long. Heating times for 6 to 20in diameter circles, ranging from 0·020 to 0·080in thick, vary from 1½ to 4 minutes. The output of 12in diameter circles of 18 gauge material is a little over 2 cwt per hour.

The flash annealing furnace installed at Dolgarrog



ELECTRICITY OUTPUT AND SALES

Effect of Weather on Consumption

COMPARED with the 11·5 per cent rise in electricity output in the first half of 1958, the rate of expansion so far this year has been a modest 5·6 per cent. The former figure was, however, inflated by the severe weather in the early part of the year, while last winter was unusually mild. A better guide to the rate of growth is to be found in the 7·4 per cent increase in June, a month in which space heating is not a significant factor.

Substantial extensions to power station plant were made in May and June, giving a net increase in installed capacity of 472 MW. At C.E.G.B. stations new sets and boilers commissioned included the following:—Belvedere L.P., 60 MW English Electric set and 550 klb/hr John Brown boiler; Castle Donington, 100 MW Metropolitan-Vickers set and 830 klb/hr Babcock & Wilcox boiler; Portishead "B," 65 MW Metropolitan-Vickers set; Elland, 60 MW Metropolitan-Vickers set and 550 klb/hr Yarrow boiler; Blyth "A," 120 MW Metropolitan-Vickers set and 860 klb/hr Babcock & Wilcox boiler; Ferrybridge "B," 100 MW C. A. Parsons set and 760 klb/hr Babcock & Wilcox boiler; and Portishead "B," 300 klb/hr Mitchell boiler. The North of Scotland Hydro-Electric Board commissioned a 2,000 kW English Electric generator and Boving turbine at Lochay and a 550 kW Gilbert, Gilkes & Gordon set at Errochty. No new plant was installed by the South of Scotland Electricity Board. During June the Galashiels station (5·6 MW) was taken out of commission, reducing the Board's aggregate installed plant capacity to 1,651 MW.

In addition to public supplies, 5,609 million kWh was generated by industry in the 26 weeks ended 4th July last, 3 per cent more than in the corresponding period of 1958. The totals for various industries were as follows (in million kWh, with percentage change in parentheses):—Chemicals: Nuclear power stations, 504 (+131·1); other, 1,565 (+2·1). Iron and steel, 1,127 (−10·3). Engineering, 609 (−10·7). Textiles, leather and clothing, 290 (−3·1). Food, drink and tobacco, 185 (+10·3). Paper, 1,142 (+3·8). Other industries, 188 (+0·1). Railways, transport undertakings, coal mines, gas works and petroleum refineries are not included in this return.

TABLE 1.—ELECTRICITY GENERATED AND PLANT INSTALLED

	Fuel consumed Thousand tons			Electricity generated Million kWh			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
May								
Central Electricity G.B.	3,068	88	310·9	7,089	4	7,097	6,658	25,829
North of Scotland H.E.B. ...	6	—	1·1	10	130	145	144	1,013
South of Scotland E.B.	215	4	0·2	410	18	428	402	1,658
Total for May, 1959	3,289	92	312·2	7,509	152	7,670*	7,204	28,500
Corres. total for May, 1958 ...	3,405	75	161·2	7,167	145	7,324	6,879	26,996
Inc. or dec., per cent	−3·4	+21·7	+93·6	+4·8	+4·8	+4·7	+4·7	+5·6
June								
Central Electricity G.B.	2,849	90	315·3	6,728	2	6,734	6,311	26,076
North of Scotland H.E.B. ...	11	—	1·2	22	99	126	125	1,012
South of Scotland E.B.	224	4	0·2	429	6	435	408	1,651
Total for June, 1959	3,084	94	316·7	7,179	107	7,295*	6,844	28,739
Corres. total for June, 1958 ...	3,126	73	171·3	6,657	126	6,793	6,377	27,004
Inc. or dec., per cent	−1·4	+28·8	+84·8	+7·9	−15·4	+7·4	+7·3	+6·4
Six months								
Jan.-June, 1959	23,258	605	2,002·2	52,023	1,053	53,145	50,032	
Jan.-June, 1958	24,027	517	860·6	49,145	1,098	50,328	47,361	
Inc. or dec., per cent	−3·2	+17·1	+132·6	+5·9	−4·1	+5·6	+5·6	

* The total figure includes generation by other methods.

Boards' Sales

Table 2 shows the sales of individual Boards during the months of May and June and for the twelve months ended 30th June. In England and Wales, the Southern Board had the highest increase in the year ended 30th June last with 10·3 per cent; for all Area Boards the average was 5·2 per cent. Sales in the South of Scotland Electricity Board's district totalled 6,869 million kWh, an increase of 6·1 per cent. In addition to the 5,834 million kWh sent out from the Board's own stations, 546 million kWh (against 385 million) was imported from the C.E.G.B., 397 million kWh (352 million) from the North of Scotland Board and 91 million kWh (nil) from the U.K.A.E.A.'s Chapelcross station.

TABLE 2.—ELECTRICITY SENT OUT BY ELECTRICITY BOARDS FOR THEIR CONSUMERS

Board	Totals for May (Million kWh)			Totals for June (Million kWh)			Twelve Months Totals Ended 30th June (Million kWh)		
	1958	1959	Inc. or Dec. %	1958	1959	Inc. or Dec. %	1958	1959	Inc. or Dec. %
London	522·2	552·0	+ 5·7	464·9	480·5	+ 3·3	7,542·8	7,868·4	+ 4·3
South Eastern	377·5	397·9	+ 5·4	330·9	352·9	+ 6·6	4,998·4	5,372·2	+ 7·5
Southern	475·1	514·4	+ 8·3	425·3	473·5	+11·3	6,302·0	6,948·5	+10·3
South Western	240·0	250·7	+ 4·7	222·1	235·5	+ 6·0	3,065·0	3,292·8	+ 7·4
Eastern	591·9	637·9	+ 7·8	535·9	576·2	+ 7·5	7,999·7	8,500·0	+ 6·3
East Midlands*	502·5	543·8	+ 8·2	484·0	518·7	+ 7·2	6,677·3	7,081·1	+ 6·0
Midlands*	652·1	699·3	+ 7·2	612·9	680·3	+10·9	8,658·3	9,233·6	+ 6·6
South Wales*	410·3	425·8	+ 3·8	386·7	412·4	+ 6·6	4,973·6	5,182·4	+ 4·2
Merseyside and North Wales*	414·6	433·8	+ 4·6	388·7	417·8	+ 7·5	5,238·7	5,497·4	+ 4·9
Yorkshire*	652·3	683·4	+ 4·8	620·3	681·3	+ 9·8	8,633·2	8,810·2	+ 2·0
North Eastern*	397·3	410·7	+ 3·4	363·6	390·1	+ 7·3	5,033·7	5,192·1	+ 3·2
North Western*	683·9	686·3	+ 0·4	635·2	672·5	+ 5·9	8,898·0	9,116·0	+ 2·4
Total all Area Boards	5,919·7	6,236·0	+ 5·3	5,470·5	5,892·7	+ 7·7	78,020·7	82,094·7	+ 5·2
Direct Supplies by C.E.G.B.	245·6	274·9	+11·9	237·1	273·4	+15·3	2,739·4	3,149·8	+15·0
Grand Total	6,165·3	6,510·9	+ 5·6	5,707·6	6,166·1	+ 8·0	80,760·1	85,244·5	+ 5·6
Mainly Industrial Areas*	3,713·0	3,883·1	+ 4·6	3,491·4	3,774·1	+ 8·1	48,112·8	50,112·8	+ 4·2
Mainly Non-Industrial Areas	2,206·7	2,352·9	+ 6·6	1,979·1	2,118·6	+ 7·0	29,907·9	31,981·9	+ 6·9
South of Scotland E.B.	493·3	511·9	+ 3·8	442·3	479·6	+ 8·0	6,475·3	6,868·9	+ 6·1
North of Scotland H.E.B.	111·5	113·0	+ 1·3	99·9	105·0	+ 5·1	1,505·6	1,561·2	+ 3·7

* Those in which industrial consumers took over 50% of the total sales in the preceding financial year.

Financial Section

STOCKS and SHARES

WITH a disregard for the influences which normally reduce interest in investment affairs to a minimum at this time of year, Stock Exchange markets took a new lease of life from the beginning of August. During July the course of prices had developed a distinctly downward tendency, promoted mainly, it was thought, by profit-taking sales as a precaution against the General Election uncertainty. Anxiety on that account lightened appreciably upon the announcement of the proposed meetings between the heads of the American and Russian States. With encouragement forthcoming also in the shape of further good news on the financial, economic and company fronts, buyers returned with every sign of confidence to the industrial market. Foreign interest in British industrials was believed to have contributed to a fresh and widespread rise in quotations, which lifted the price indices to new all-time record levels.

Company News

For the electrical markets of the Stock Exchange the past two months have been eventful for the appearance of several big new capital issues and for a number of good company dividend and profits statements. In the former category the principal operations were Electric & Musical Industries' "rights" offer of ordinary shares, involving some £4 million new money; a similar issue on only a slightly smaller scale by Pye; and issues raising about £8 million for International Computers & Tabulators. Of the dividend declarations made in the same period, one of the most notable was the doubling of the Berry's Electric Magicoal distribution—accompanied by indications of a further increase next time. Higher payments were declared also by, among others, E. K. Cole, B.E.T., W. H. Allen, De la Rue, Vactric, Marryat & Scott, Ward & Goldstone, Thorn Electrical, and Electrical Components. Several scrip issues were distributed, including those by English Electric, Chloride Electrical, Plessey, Walsall Conduits, and Lancashire Dynamo.

G.E.C. Results

General Electric Company £1 shares have been well supported since the decision to maintain the dividend at a total of 10 per cent, as before, for the year ended last March. They improved further to about 38s 3d in response to the tenor of Sir Leslie Gamage's review accompanying the full report. Seeing that the interim dividend had been reduced in January from 3½ to 3 per cent, and had been accompanied by a warning of continued pressure on profit margins, the results for the full period exceeded market expectations. Turnover reached the record figure of £108 million, and although much heavier depreciation provisions brought the net trading profit below last year's, the difference was more than offset by a lighter tax charge, the outcome being an increase of some £400,000 to £2·12 million in the

Price Changes in

Company or Board	Nom. Value	Middle price 10th Aug.	Dividend Previous	Dividend Last	Yield %	1959 Highest	1959 Lowest
Gilt-edged Stocks					£ s d		
Brit. Elec. 1968/73	100	80	3	3	3 15 0	80½	77½
Brit. Elec. 1974/77	100	77	3	3	3 18 0	77	74½
Brit. Elec. 1976/79	100	80½	3½	3½	4 7 0	80½	77½
Brit. Elec. 1974/79	100	91	4½	4½	4 13 6	91	87½
Overseas Electric Supply							
Calcutta Elec.	£1	19/6	6·8†	7†	12 10 0	19/6	16/-
East African Power	£1	20/-	7½	8	8 0 0	22/3	19/3
Nigerian Elec.	£1	13/-x.d.	8	8	12 6 0	15/-	13/9
Perak Hydro-Elec.	£1	13/6	12½	10	14 16 3	14/6	12/3
Electrical Shares							
Aberdare Holdings	5/-	16/9	17½	17½	5 4 6	16/9	15/6
Aerialite	1/-	8/3	51½	54	6 10 9	9/6	7/9
Allen, W. H.	£1	51/3	11	12	4 13 9	51/3	43/-
Allied Insulators	5/-	20/-	—	20‡	5 0 0	20/-	18/9
Anglo-Portuguese Tel.	£1	29/3	9	9	6 3 0	29/3	26/6
Aron Elec. Ord.	£1	55/-	15	15	5 9 0	62/6	55/-
Assoc. Elec. Ord.	£1	63/6	15	15	4 14 6	63/6	53/9
Automatic Tel. & El.	£1	71/3	17	17‡	4 18 3	82/6	71/3
Babcock & Wilcox	£1	54/6	13‡	13	4 15 6	54/6	45/6
Bakelite	10/-	31/3	15	15	4 16 0	31/3	22/-
Baldwin, H. J.	2/-	2/6	20	20	—	3/-	2/3
Berry's Electric	5/-	28/-x.d.	10	20	3 11 6	28/-	10/9
Bowthorpe Holdings	2/-	13/9	25	27	3 18 6	15/6	11/9
British Elec. Traction: Def. Ord. "A"	5/-	39/-	25	35	4 9 9	40/-	35/6
B.I. Callender's	£1	51/3	12½	13½	5 5 3	56/6	44/9
B.I. Callender's 6% Pref.	£1	20/-	6	6	6 0 0	20/6	19/9
British Thermostat	5/-	24/6x.c.	30	35	3 11 9*	25/-	18/6
British Vac. Cleaner	5/-	7/-	10	7½*	5 7 0	7/9	4/6
Brook Motors	10/-	48/9	25	24½*	4 19 0	54/3	46/-
Bulgin, A. F.	1/-	9/-	45	50	5 11 0	10/-	6/9
Bulpitts	5/-	17/3	—	15	4 7 0	17/3	10/-
Burco Dean	5/-	15/9	22½	16*	5 1 6	15/9	12/3
Cable & Wireless: Ord.	5/-	14/3	10	10*	3 10 3	15/-	12/3
4% Loan	100	94½	4	4	4 4 9	95	93
Chloride El. Storage "A"	£1	52/6x.c.	17½	20‡	5 1 6*	53/4	43/8
Clarke Chapman	£1	52/6	27½	13‡*	5 4 9	66/3	52/6
Cole, E. K.	5/-	21/-	17½	20	4 15 3	21/3	17/3
Contactor Switchgear	5/-	15/-	20	14*	4 13 3	15/-	12/-
Cossor, A. C.	5/-	7/6	2½	Nil	Nil	9/-	6/3
Crabtree	10/-	30/3	20	20	6 12 3	31/6	28/-
Crompton Parkinson	5/-	13/6	16	12*	4 8 9	14/3	11/9
Davis & Timmins	5/-	17/-	18	20	5 17 9	17/-	14/6
De La Rue	10/-	51/3x.r.	17½	20	3 18 0	54/-	30/3
Decca "A"	10/-	35/-x.d.	43½	50	5 14 3	40/3	33/3
Desoutter	5/-	27/6	32½	21½*‡	3 18 9	27/6	19/-
Dewhurst	2/-	8/3	20	20	4 16 9	8/3	7/3
Dictograph Tel.	2/-	7/6	20	20	5 6 9	8/3	7/-
Dubilier Condenser	1/-	4/6	20	25	5 11 0	5/-	3/3
Duport	5/-	11/9	25	12½*	5 6 6	12/-	10/3
E.M.I.	10/-	51/6x.r.	15	20*‡	3 17 9	64/6	48/-
Electrical Apparatus	5/-	13/9	12½	14½	5 5 6	14/-	13/-
Electrical Components	5/-	14/3	12½	15	5 5 3	14/3	10/6
Elec. Construction	£1	33/6	8½	9	5 7 6	33/6	27/9
Elliott-Automation	5/-	23/9	—	10‡	2 2 0	30/6	16/9
Enfield Cable Ord.	£1	21/3	2½	Nil	—	22/3	16/3
English Electric	£1	44/9x.c.	14	14	4 3 0*	45/-	37/10
English Electric 3½% Pref.	£1	13/-	3½	3½	5 15 6	12/9	12/3
Ericsson Tel.	5/-	22/3	12†	13†	5 1 6	27/3	22/3
Ever Ready	5/-	22/-x.c.	20	27½‡	3 19 6*	23/5	13/3
Falk Stadelmann	£1	25/-	17½	10*‡	8 0 0	32/9	25/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

surplus. This gave cover of about 1¾ times for the 10 per cent dividend.

Further Prospects

The G.E.C. chairman told shareholders in the annual report that as a sequel to last year's change in Government policy, sales in the domestic equipment and radio divisions of the group increased remarkably towards the end of the financial year. On the sides of the business concerned with plant and equipment for industrial expansion, reactions had been slower to appear. He expected a continuance of increased demand for electrical consumer goods, although perhaps at a slower rate, and that the demand for capital goods would gather momentum as the year progressed. He gave also an account of the important steps taken in internal organisation to improve the group's efficiency and earning capacity, and taken altogether his review of the outlook was read in the market as distinctly encouraging. At their present price the shares are showing a yield of 5¼ per cent.

Electrical Investments

Company or Board	Nom. Value	Middle price 10th Aug.	Dividend Previous	Dividend Last	Yield % £ s d	1959 Highest	1959 Lowest
Electrical Shares—continued							
G.E.C.	£1	38/3	10	10	5 4 6	40/3	31/3
G.E.C. 6½% Pref.	£1	22/-	6½	6½	5 18 3	22/-	20/3
General Cables	5/-	8/9	24	15	8 11 6	9/3	7/6
Greenwood & Batley	£1	105/-	20	30	5 14 3	105/-	75/-
Hackbridge Holdings	5/-	19/3	20	20	5 4 0	19/3	14/3
Hackbridge & Hewittic	5/-	19/3	20	20	5 4 0	19/3	13/9
Head Wrightson	5/-	27/6	17½	20	3 12 9	28/6	24/3
Heatrae	2/-	8/-	20	20	5 0 0	10/-	7/6
Holophane	5/-	16/9	37½	22½*	6 14 3	16/9	14/9
Hoover	5/-	74/6x.d.	50	60	4 0 6	74/6	55/-
I.C.I.	£1	38/6	12	8*	4 3 0	38/6	33/-
Intl. Combustion	5/-	33/9	25	30‡	4 9 0	36/6	29/9
Intl. Computers & T.	£1	66/3x.r.	—	8‡	2 8 3	78/9	57/6
Johnson & Phillips	£1	23/-	5	5	4 7 0	30/6	22/-
Lancashire Dynamo	£1	42/6x.c.	11	12½‡	4 8 3*	43/1	31/6
Laurence Scott	5/-	16/9x.c.	15	15	3 3 9*	16/9	14/-
Lister, R. A.	£1	39/6	10	12½	6 6 6	41/-	32/9
Lucas, J.	£1	51/3	7½	10‡	3 18 0	51/3	43/3
Marconi Marine	£1	42/-	10	10	4 15 3	48/6	40/-
Marryat & Scott	2/-	9/9	37½	22½*	4 12 3	10/-	8/6
Mather & Platt	£1	43/-x.d.	15	10‡*	4 19 3	51/6	41/3
Metal Industries	£1	53/9	14	14	5 4 3	53/9	39/9
Midland Elec. Mfg.	£1	45/-	12½	10*	4 9 0	45/-	41/6
Morphy-Richards	4/-	28/-	20	20	2 17 3	28/-	18/-
Murex	£1	49/6	17½	15	6 1 3	49/6	42/-
Newman Ind.	2/-	3/-	10	10	6 13 3	3/-	2/3
Oldham & Son	1/-	2/9	17½	17½	6 7 3	3/-	2/6
Parsons, C. A.	£1	45/9	7½	8½‡	3 11 0	55/9	45/9
Philips' Lamps	Fl.10	126/3	14	14	2 1 9	126/3	88/-
Plessey	10/-	31/6x.c.	30	30	3 3 6*	31/6	23/6
Pye	5/-	14/6x.r.	12½	12½	4 6 3	16/9	13/9
Pyrotenax	5/-	36/3	—	34	4 13 9	38/3	33/9
Reliance Clifton	5/-	22/-	15	15	3 8 3	22/-	17/6
Reyrolle	£1	87/6	17½	17½	4 0 0	98/-	85/9
Rheostatic	4/-	9/9	12½	12½	5 2 6	10/9	8/3
Richardsons Westgarth	10/-	12/-	8½	8½	6 18 9	15/3	12/-
Simon-Carves	5/-	28/9	25	25	4 7 0	32/-	28/6
Smith (England), S.	4/-	14/3	20	12½*‡	3 10 3	17/-	11/6
Southern Areas	£1	13/6	Nil	Nil	Nil	15/-	10/6
Strand Elec.	5/-	10/3	15	15	7 6 3	10/3	8/6
Sturtevant	5/-	17/3	15†	15†	7 11 3	20/-	17/-
Sun Elec.	5/-	13/9x.c.	25	25	4 11 0*	13/9	8/3
Switchgear & Cowans	5/-	13/6	22½	15*	5 11 0	13/6	10/3
T.C.C.	10/-	43/9	25	25	5 14 3	43/9	38/-
Telephone Mfg.	5/-	5/6	10	10	9 1 9	5/9	4/9
Telephone Rentals	5/-	16/9	12½	12½*	3 14 9	16/9	11/9
Thompson (John)	5/-	21/-	25	25	5 19 0	25/6	22/9
Thorn Elec.	5/-	33/9x.d.	17½	20	2 19 3	38/6	26/3
Thornycroft	£1	25/-	12½	7½	6 0 0	25/9	20/6
Tube Investments	£1	87/9	15	17½	3 19 9	87/9	71/6
Vactric	5/-	42/-	25	37½	4 9 3	44/6	26/3
Veritys	5/-	1/6	12½	2½	—	5/-	1/3
Walsall Conduits	4/-	11/3x.c.	22½	22½	4 11 0*	14/2	10/8
Ward & Goldstone	5/-	43/-	25	30	3 9 9	43/-	30/6
Watford	2/-	8/6	25	25*	5 17 9	9/-	7/6
Westinghouse	£1	42/6	10	10	4 14 3	47/-	39/6
West, Allen	5/-	12/3	12½	11½*	4 15 3	14/-	11/9
Wolf Electric	5/-	7/9	10	10	6 9 0	8/6	7/9

E.M.I. Issue

Electric & Musical Industries' decision to make a £4 million "rights" issue came as a surprise to the market. The 10s shares, which changed hands at over 60s earlier in this year, were lowered fairly sharply after the announcement, but when quoted "ex-rights" recovered to 51s 6d. The new shares became fully paid-up on 6th August and will be transferable free of stamp duty until the end of September. They will not participate in the final dividend for the year ended last June, which may be expected to be declared in October. An indication of the financial results for this period was given in a statement accompanying the offer. Turnover was estimated at about the previous year's level of £66 million. Trading profits would be lower but the net surplus after tax should not differ much from the 1957–58 figure of £2·16 million. Dividends were expected to fulfil earlier forecasts of a 20 per cent total, and to be kept at that rate, on the increased capital, for the year now running. This puts the shares on a probable yield basis of 3·9 per cent.

Berry's Electric Dividends

The 5s shares of Berry's Electric Magicoal, which were quoted at not much above 10s in the early part of this year, stood at more than double that figure on the appearance of the preliminary statement of the annual results, and have further advanced to 28s on the strength of the chairman's review of prospects in the full report. During the year ended last March, an expansion of net group profits from £42,000 to £122,000 provided easily for the doubling of the dividend to a total of 20 per cent, covered between four and five times over by available earnings. Proposals to give effect to a one-for-two scrip issue will come up for approval at the annual meeting on 27th August, and shareholders are told in Mr. R. Berry's statement that he hopes, in the absence of unforeseen circumstances, at least for the maintenance of the same rate of dividend on capital so increased. Should this intention materialise, it would raise the yield from the shares at their present price to a minimum of 5·4 per cent. Sales in the first quarter of the current year are stated to have been at record levels, and prospects for the rest of the period are desrcibed as favourable.

REPORTS and DIVIDENDS

General Electric Co., Ltd. — The accounts for the year ended 31st March last show a gross income from sales of £108 million as compared with £104·5 million for the preceding year, and a profit on trading of £3,950,079 (against £4,485,798), to which is added income from trade investments of £299,101. After deducting a considerably lower taxation charge of £2,125,332 (£3,040,950), the group profit is £2,123,848 (£1,724,193), of which £1,983,049 (£1,605,480) is attributable to the holding company. The dividend on the ordinary stock for the year is maintained at 10 per cent by a final payment of 7 per cent.

Sir Leslie Gamage (chairman and managing director), in his annual review, says that in the circumstances which prevailed last year it was a real achievement to have increased turnover by over £3,000,000, and more important still, they start the current year with a satisfactory order book of £133 million, considerably higher than last year. They had increased their exports, over a period in which total British exports showed some decline, despite fierce competition, which forced down profit margins. A change of Government policy had immediately affected the domestic equipment and radio divisions, which showed a remarkable increase in the last few months of the year, but it had no time to take effect upon the rest of the organisation and it is only quite recently that they have felt some signs of revival in demand for the wide range of industrial products.

The company's reorganisation continued during the year by splitting the General Products Group into divisions. In the Engineering Group similar divisionalisation has taken place.

The Hunterston nuclear power station is making reasonably good progress, but has been set back by about three months, mainly as a result of numerous unofficial strikes. Design work is proceeding on the 150 MW nuclear power station for Japan. Sir Leslie says that there is only a limited market for the present form of gas-cooled graphite-moderated reactor overseas owing to its high capital cost. An intensive new approach to reactor dimensions and electrical capacity is necessary to reduce capital cost. The G.E.C. has carried out pioneer work in this direction, the outcome of which has been seen in the design study submitted to the Admiralty covering a reactor for marine propulsion.

Sir Leslie says that home sales for the General Products Group showed an increase over the previous year of 8 per cent, spread over the Group as a whole, with particularly marked increases in the domestic equipment, lighting and radio divisions. "Osram" lamps continued to hold the largest share of all lamp sales in the United Kingdom and make an important contribution to the company's exports.

Business in the installation equipment division was maintained despite the slowing down of building programmes. The credit restriction policy continued to be felt in the demand for cables until the end of 1958. There has been a slight improvement, but since the end of the financial year, price cutting has eaten into profits. In the radio division, after credit relaxations in November their position in the market was greatly strengthened. In the domestic equipment division turnover rose by over 40 per cent, spread over both the major equipment and the smaller appliances.

The heavy engineering industry is showing signs of improvement following an eighteen months' period in which capital expenditure on heavy equipment was at a low level. The company's order book reflects these trends and there has been a distinct improvement towards and since the end of the financial year.

Sir Leslie says that he is not happy with the position of the telephone industry. The company's works were laid out to meet the anticipated increase in requirements based on the G.P.O.'s programme for several years ahead. In the year just ended, orders from the G.P.O. fell woefully short, and its programme appears no better for the current year.

Ferranti, Ltd.—In his review of the year ended 31st March last, Sir Vincent de Ferranti (chairman) says that the improved result for the year is due to a number of factors. On armaments, they have started to produce equipment which they have been developing for a number of years. On the other hand, the change in the Defence Programme will reduce activity in the departments making conventional armaments, and they will feel the effect of this more in the current financial year. The sales of new products, such as silicon-diodes, have increased, and their decision to spend considerable sums of money in the past on research and development is now being justified by results. Also, this is the first year that they have had the full benefits of the decision taken two years ago to reduce their activities in the field of domestic household products.

They have concentrated more and more in recent years on electronics. However, this relatively new field requires intensive and costly research and development programmes before the final product or system can be manufactured economically for home and export markets. Outstanding among those products which have a high technological content is the range of electronic digital computing equipment of which some forty installations are in the hands of customers. All orders so far received for the new "Perseus" computer are for export. Another field of complex electrical and electronic equipment in which they are firmly established is that of guidance systems for use both in connection with manned aircraft and with missiles.

Although the output of power transformers and associated equipment has once again risen slightly, the input both from home and overseas markets shows a considerable fall, reflecting the fact that there is now an excess of manufacturing capacity over demand, both in this country and globally. The production of synthetic-resin-bonded paper tubes and cylinders has continued to increase. The major influence in the electricity meter business is the pressure to reduce prices, both in the home and export markets. Overseas, certain European competitors have re-appeared and several Commonwealth countries are beginning to manufacture their own.

In Canada, the merger between Ferranti Electric, Ltd., and Packard Electric Co., Ltd., to form Ferranti-Packard Electric, Ltd., has been completed successfully, and is resulting in considerable economies in the sales, engineering and manufacturing divisions.

E. K. Cole, Ltd.—The annual meeting was held on 29th July, Mr. E. K. Cole (chairman and managing director) presiding. In his statement, which had been previously circulated, Mr. Cole said that sales of domestic equipment manufactured by the group were extremely good during the selling season of the financial year under review. With the relaxation of hire-purchase restrictions the turnover in television and radio increased and was a new record, although the profit margins were somewhat lower. Their activities in all export markets had continued and although the turnover exceeded last year's figure, he emphasised that their efforts in this field still proved to be a costly operation which could be supported only by successful trading in the home market.

The board hoped at the appropriate time to make a rights issue to ordinary stockholders. Following the adoption of the report and accounts, resolutions were passed authorising an increase in capital from £1,450,000 to £1,700,000 by the creation of 1,000,000 ordinary shares of 5s each.

John Thompson, Ltd.—The annual meeting was held on 21st July, Sir Edward Thompson (chairman and managing director) presiding. In his circulated statement, the chairman said that orders on hand at the end of 1958 at £25·6 million showed a considerable drop as compared with the figure of £35·2 million at the end of 1957. The recent trade recession had had its repercussions in the field of heavy engineering. Industrial capital investment was still at a much lower level than in recent years and orders were still coming in at a lower rate than usual, and for the first three months of 1959 were appreciably lower than for the corresponding period of last year. Comparisons for a three-month period could be misleading and the picture could look entirely different if an order for a further atomic power station were received or even one for a large conventional station. Last year he gave an opinion that there was adequate, if not excess capacity in the boilermaking industry for all power station requirements, both nuclear and conventional types. This had proved to be true. On the nuclear side, due to deferment or putting back of the official programme, they and their associates secured only one nuclear power station order. High overhead costs for design and development were continuing, which meant that any adequate return on the nuclear work was a long term prospect.

Metal Industries, Ltd.—In his circulated statement, Sir Charles Westlake (chairman) mentioned the merging of the two electrical control gear subsidiaries, Brookhirst Switchgear, Ltd., and the Igranic Electric Co., the new organisation being known as Brookhirst Igranic, Ltd. Efforts were being made to capture a larger share of the European market; leading this drive was a new company, Brookhirst Igranic (Europe), S.A., with headquarters in Brussels. In South Africa, Igranic S.A. (Pty.), Ltd., made steady and profitable progress in its newly-extended factory.

At the annual meeting held on 29th July, Sir Charles said that the profits for the current year to date continued to show an upward trend, being significantly higher than for the corresponding period of last year. While the major part of this increase was due to recent acquisi-

tions, a worth-while improvement had also been shown by some of the longer established group companies. In his opinion, however, undue significance should not be attached to these figures: they applied to only part of the year, and the company had reason to believe that business, especially in electrical equipment, was likely to prove more competitive in the near future.

Richardsons, Westgarth & Co., Ltd.—Dealing with the various companies in the group in his annual review Mr. O. J. Philipson (chairman), in referring to Richardsons, Westgarth (Hartlepool), Ltd., said that two steam turbo-alternator sets were commissioned for the C.E.G.B.—the last of five 30 MW sets in the Acton Lane power station and the last of six sets (a 60 MW set) at Brighton "B" power station. Marine steam turbine installations totalling over 40,000 shaft h.p. in all were completed at Hartlepool. Work in hand included two 60 MW steam turbo-generator sets for the South Denes, Yarmouth, power station of the C.E.G.B.

Referring to Atomic Power Constructions, Ltd., in which the group holds a considerable interest, Mr. Philipson said that subsequent to the close of the past year the C.E.G.B. had placed the contract for the atomic power station at Trawsfynydd with this consortium. The station was to be commissioned in 1964 and would have an output of 500 MW.

Regarding the future, although at the end of the financial year the group's orders in hand stood at £34 million (£50 million a year before), interruptions to production arrangements had already risen, and, so far as could be seen, might well increase. Failing some substantial alteration in the outlook by the end of the present year, further reductions in output would be inevitable and redundancy in personnel unavoidable.

Hackbridge & Hewittic Electric Co., Ltd.—In his review of the year to 31st March last, Mr. A. M. Browne (chairman and managing director) says prices and profit margins have continued to decline. However, improved design and production methods have made it possible to compensate for this downward trend sufficiently to achieve financial results comparable with the previous year.

Most of the output from the factory has been in power transformers and mercury arc rectifiers, but steady progress has been made in the development of the new lines of manufacture mentioned in the past two reports. The output of high power quartz lamps has now reached a good economic level and the range of overhead line switchgear commenced two years ago has been materially expanded. The manufacture of germanium rectifier diodes has also progressed well. During the past financial year and continuing during the months of the current year orders have been obtained at a good and increasing rate. Operation at full capacity in all divisions during the current year is assured.

Ward & Goldstone, Ltd.—In the course of his review of the year ended 31st March last, Mr. S. Goldstone (chairman and managing director) says that the order of static economy to which he referred in his previous review, prevailed for the greater part of the year, affecting considerably many of those industries which they serve and infecting many export markets, to which shipments were substantially reduced. These conditions inevitably induced a contraction in demand and brought about the most intensive competition within a section of the industry with a much expanded production potential; trading operations were, therefore, more difficult and less profitable in proportion to volume than in any year since the end of the war. However, by virtue of their varied interests, they produced a greater quantity than ever previously achieved, while group sales and earnings increased, although by a very slender margin.

Ada (Halifax), Ltd. — The annual meeting was held on 21st July, Lt.-Col. W. D. Gibbs (chairman) presiding. In his circulated statement the chairman said that the increase in profit for the year under review could be attributed to the turnover being nearly doubled in spite of intense competition. The plant and equipment for the new factory for the production of refrigerators had now been installed and the plant was working satisfactorily. Government and planning consents had been obtained to the extension of the main engineering works in Johnson Street, Halifax, and work had already commenced.

Hoover, Ltd., announces that, after estimated taxation of £3,084,000, the net profit attributable to the parent company for the first half of the current year is £2,553,000, as compared with £852,000 for the corresponding period of 1958. The interim dividend on the ordinary and "A" ordinary shares is unchanged at 10 per cent. The directors state that while the general prospects for the second half of the year look satisfactory, it is not expected that the present high volume sales on the home market will continue and there are signs that the demand is beginning to fall. Conditions on the Continent generally, because of the advent of the Common Market, are making the company's position there much more difficult and it will not be an easy task to maintain its present level of exports.

Venner, Ltd.—In their report for 1958, the directors state that the company's range of time switches and electro-mechanical instruments continues to sell throughout the world. The silver zinc accumulator made by Venner Accumulators, Ltd., is selling in increasing volume and that company is now contributing to the profits of the group. The Electronics Department has operated with sufficient success to justify the department being enlarged considerably. Plans are in an advanced stage for adding further instruments to the group's range of products. Since the close of the financial year, deliveries from all departments have shown a marked upward trend.

Transformers (Watford), Ltd.—In his address to stockholders at the recent annual meeting of the London Brick Co., Ltd., of which Transformers (Watford), Ltd., is the manufacturing subsidiary, Mr. A. T. Worboys (chairman) said that Transformers (Watford) enjoyed a year (its 21st year) marked by a substantial improvement in trading results. The output reached a record level—some 30 per cent above 1957. This increased production enabled them to counteract to some extent the effect of the fall in selling price levels occasioned by the continued severe competition in both home and export markets. Orders on hand at the turn of the year were commensurate with the company's increased manufacturing facilities.

Telephone Manufacturing Co., Ltd.—The annual meeting was held on 13th July, Mr. F. T. Jackson (chairman and managing director) presiding. In his statement, which had been previously circulated, the chairman said that they were now suffering from the loss of business from the British Post Office for subscribers' apparatus and whilst it was possible to maintain in 1957 the rate of turnover achieved in 1956 with the help of business from other sources, it had proved impossible to offset the further reduction experienced in the year under review. Deliveries of this type of equipment were running at one-third of the rate in 1956 and total turnover showed an overall reduction of 15 per cent. The proportion of turnover exported, which was 19 per cent in 1956 and 26 per cent in 1957, increased to 30 per cent in 1958. Their line transmission business had been well maintained and the Capacitor Division was growing steadily.

Electric Construction Co., Ltd.—In his statement accompanying the report and accounts for 1958-59, Mr. C. Reid (chairman) said that competition both at home and abroad intensified during the period under review, resulting in lower profit margins. The output during the year was at a record level, despite the general recession in trade. Purchasing power was restricted and was reflected in the order book, but the easing of credit restrictions had resulted in an increase in business activity.

Heatrae, Ltd.—In his circulated statement covering the year 1958-59, Mr. C. H. Smith (chairman and managing director) said that the fall in the net profit was due to a sudden increase in the cost of certain raw materials, a substantial increase in wages following national agreement, and keen competition in some domestic apparatus prices which they had to combat. The turnover for the year established a record. In view of the widening variety and increased complexity of their products a firm of consultants were engaged to investigate their methods of manufacturing and costing. As a result of the consultants' recommendations some changes had been made, the results of which should be felt in the present year.

British Thermostat Co., Ltd. — The annual meeting was held on 27th June, Mr. J. E. Sherlock (chairman and managing director) presiding. In his statement, which had been previously circulated, the chairman said that the company and its subsidiaries had had another successful year. The decline in the aircraft control business referred to in his previous review did not materialise to the extent expected. They also took full advantage of the boom which occurred in the sale of domestic appliances following the relaxation of the credit squeeze. In general there was an appreciable decline in the ratio of profit to turnover but this was more than offset by the increased volume of business.

With regard to 1959, they must face a serious decline in their aircraft business, and the capital released would be diverted to finance and expand the other subsidiaries and divisions engaged in the commercial controls field.

Simms Motor & Electronic Corporation, Ltd.—In the course of his review of the past year, Mr. G. E. Liardet (chairman and managing director) said that in the first half of the year profits were well maintained, but recession of demand in the third quarter and to a lesser extent in the last quarter, coupled with a wages increase, caused a diminution in the rate of profit. The order book was greater

than at this time last year, the turnover showed a substantial increase and profit was also higher.

East African Power & Lighting Co., Ltd.—In his circulated statement covering the year ended 31st December last, Mr. A. J. D. Small (chairman) said that earlier in the year the Kenya and Tanganyika undertakings appeared to have settled down to an annual increase of around 10 per cent in kWh and revenue, which they felt was a little disappointing compared with the figures in the first half of the decade. Despite continuance of the recession to which he referred in his last statement, the principal undertakings in Kenya and Tanganyika showed a trend towards improved sales in the latter months of the year, a trend which had been continued into the current period.

Peerless & Ericsson, Ltd.—In his speech at the annual general meeting held on 7th July, Mr. J. H. Senior referred to the proposed merger with Kenwood Manufacturing Co., Ltd., and said he hoped to inform shareholders of the proposals by about October next.

Crabtree Electrical Industries, Ltd., has acquired for cash all the issued share capital in the private company of C. M. Churchouse, Ltd., manufacturers of electric lighting fittings and its wholly owned subsidiary company, Robbins & Bradley, Ltd., Birmingham, manufacturers of electric lighting fittings and accessories. The purchase has been financed out of the company's liquid resources, and will not involve any increase in capital.

Thorn Electrical Industries, Ltd., announces that it is proposed to raise a sum of between £5 million and £6 million in the near future by an issue of unsecured loan stock and by a rights issue of ordinary shares to ordinary and "A" ordinary shareholders.

Engineering & Lighting Equipment Co., Ltd.—Speaking at the annual meeting held on 8th July, the Earl of Verulam (chairman) said that the growth in sales of their street lighting equipment had been substantial. Orders were running at a high level at the moment and this year's turnover in lighting fittings and standards would be half as high again as in 1958-59.

Greenwood & Batley, Ltd.—At the annual meeting held on 24th July, Col. H. A. Micklem (chairman) said that some reorganisation of the capital was contemplated, as total net assets were represented very inadequately.

Interim Dividends: — International Combustion Africa, 20 per cent (unchanged). **Dewhurst & Partner,** 5 per cent (unchanged). **Falk, Stadelmann,** 5 per cent (7½ per cent) on capital increased by a scrip issue. **R. A. Lister & Co.,** 5 per cent (2½ per cent). **Marco Refrigerators,** 2½ per cent (unchanged). **R. B. Pullin & Co.,** 5 per cent (unchanged). **Cable & Wireless (Holding),** second interim 2½ per cent (unchanged). **Mather & Platt,** 3 per cent (4 per cent) on increased capital. **Hoover,** 10 per cent (unchanged). **Lancashire Dynamo Holdings,** 3 per cent (4 per cent) on increased capital. **British Oxygen Co.,** 4 per cent (unchanged).

YEAR'S RESULTS AND DIVIDENDS

Company	Net Profit 1958-59	Net Profit 1957-58	Dividend 1958-59	Dividend 1957-58
	£	£	%	%
Aron Electricity Meter	17,194	38,486	15	15
	(loss)	(profit)		
Belliss & Morcom	43,818	74,626	(e) 10½	11
Berry's Electric Magicoal	121,971	42,343	(c) 20	10
British Relay Wireless & Television	300,908	232,418	(n) 20	20
Cables Investment Trust	440,843	396,430	10	10
George Cohen 600 Group	657,739	817,177	12	12
E. K. Cole	403,873	311,140	20	17½
Dubilier Condenser	130,270	114,077	25	20
Efco	154,474	124,228	17½	15
Electric & Gen. Investment	41,932	39,367	(a) 12	12
Electric Construction	121,559	109,014	9	8½
Electrical Components (Holdings)	141,938	125,907	(a) 15	12½
Ferranti	1,104,572	575,971	(a) 6	6
General Electric Co.	1,983,049	1,605,480	10	10
Globe Telegraph & Trust Co.	619,748	517,480	(a) 10	10
Greenwood & Batley	141,104	124,293	30	20
Hackbridge & Hewittic	183,958	164,816	(b) 20	20
Hick, Hargreaves	329,305	419,487	(f) 16	20
International Aeradio	8,833	12,149	Nil	Nil
Johnson, Matthey	828,282	934,492	(c) 12	10
Keith Blackman	134,984	192,153	17½	17½
George Kent	278,586	265,749	(f) 17	17
Geo. W. King	107,881	133,488	(a) 12½	12½
Marryat & Scott (Holdings)	106,094	92,741	(a) 22½	37½
Metal Industries	810,866	779,753	(a) 14	14
Mirrlees Watson Co.	126,023	111,396	15	(i) 15
Murex	334,000	291,000	15	17½
Newton Bros. (Derby)	72,730	69,029	(h) 16	20
Oldham & Son	171,167	236,931	17½	17½
Parmiter, Hope & Sugden	17,443	31,899	20	30
Phœnix Telephone & Electric Holdings	2,337	87,895	10	20
Pinchin, Johnson & Associates	867,970	748,827	16½	16½
Pirelli-General Cable Works	509,764	444,253	15	15
Pye	900,957	749,673	(a) 12½	12½
Radio & Allied (Holdings)	617,683	—	22½	—
Rediffusion	1,423,329	914,092	16	(j) 12½
Renold Chains	495,561	558,770	(a) 12½	12½
Ruston & Hornsby	577,875	765,684	8	9
James Scott & Co. (Electrical Engineers)	119,791	97,212	24	22
Simms Motor & Electronic Corp.	266,072	423,881	(k) 12½	(g) 19½
Southern Areas Electric Corporation	5,153	10,302	Nil	Nil
	(loss)	(profit)		
Telefusion	149,518	70,050	(m) 25	—
Thorn Electrical Industries	979,371	681,832	20	17½
Ultra Electric	206,890	114,191	20	15
Vactric	156,481	159,785	(a) 37½	25
Venner	38,852	32,781	(c) 15	15
Ward & Goldstone	478,205	447,934	30	25
Watsham's	41,289	36,677	15	15
Wilkins & Mitchell	323,746	176,943	(d) 17	—

(a) On larger capital.
(b) One-for-three scrip issue proposed.
(c) One-for-two scrip issue proposed.
(d) One-for-four scrip issue proposed.
(e) Including special tax-free distribution of 2½ per cent from surplus on investment sales.
(f) Including bonus of 4 per cent and paid on larger capital.
(g) Final payment of 9½ per cent on increased capital.
(h) Including bonus of 6 per cent; also paid on increased capital.
(i) Including bonus of 5 per cent.
(j) Including special "profits tax" non-recurring dividend of 3½ per cent.
(k) Including a special interim dividend of 6½ per cent on account of 1959.
(l) Including bonus of 2 per cent.
(m) Company made public in September, 1958; final dividend of 17½ per cent on increased capital; one-for-two scrip issue proposed.
(n) Final dividend of 15 per cent on increased capital; one-for-two scrip issue proposed.

New Companies

Veritys (Fans), Ltd.—Registered 3rd July. Capital £100. Manufacturers of and dealers in electric fans, instruments and fittings, etc. Solicitors: Lee Crowder & Co., 24, Harborne Road, Birmingham, 15.

Veritys (Switchgear), Ltd.—Registered 3rd July. Capital £100. Manufacturers of and dealers in switchgear, switchboards and electrical control apparatus, etc. Other particulars are similar to Veritys (Fans), Ltd.

Veritys (Maxlume), Ltd.—Registered 30th June. Capital £100. Manufacturers of and dealers in electric lamps, instruments and fittings, bells, fires and stoves, cookers, etc. Other particulars similar to Veritys (Fans), Ltd.

RAB Productions, Ltd.—Registered 27th May. Capital £25,000. Directors: R. W. Bill, R. A. Bill, S. H. Day and H. G. Palfreyman (all directors of Bill Switchgear, Ltd., etc.), and N. Gardner. Regd. office: 49, Aston Lane, Perry Barr, Birmingham, 20. This company has been formed to take responsibility for the manufacture of all automatic work, repetition and turned parts in the manufacture of Bill switchgear.

Liquidations

Sarum Electric, Ltd., electrical engineers, 30, Milford Street, Salisbury.—Winding up voluntarily. Liquidator, Mr. D. W. Malpas, 30, Milford Street, Salisbury, appointed 30th June.

Mica Manufacturing Co., Ltd., electrical insulation manufacturers, Volta Works, Homesdale Road, Bromley, Kent.—Winding up voluntarily. Liquidator, Mr. N. K. Allen, Capel House, 62, New Broad Street, London, E.C.2, appointed 8th July.

Savage Transformers Holdings, Ltd., manufacturing electronic engineers, Nursteed Road, Devizes, Wilts.—Winding up voluntarily. Liquidator, Mr. W. B. Savage, Nursteed Road, Devizes, appointed 22nd July. Particulars of claims to the liquidator by 28th August. This notice is purely formal. All creditors have been or will be paid in full.

Bankruptcies

Edwards Electrical & Radio, 384, Finchley Road, London, N.W.2, electrical engineers.—Public examination 25th August at Bankruptcy Buildings, Carey Street, London, W.C.2.

P. R. Gliddon and **M. E. Gliddon,** trading as Star Products, domestic electrical specialists, lately carrying on business at 59, Highland Road, Southsea, Portsmouth.—Trustee, Mr. H. Pyke, Lloyds Bank Buildings, Fratton Bridge, Portsmouth, appointed 11th June.

N. G. Morgan, 28, Major Road, Canton, Cardiff, electrician.—Receiving order made 25th June on a creditor's petition. Public examination 14th October at the County Court Buildings, Westgate Street, Cardiff.

J. F. Husband, 22, Mettham Street, Lenton, Notts., electrical trade representative, lately electrical contractor.—Supplemental dividend of 9¾d in the £, payable at the Official Receiver's Office, 27, Regent Street, Park Row, Nottingham.

D. Revell (separate application), residing at 120, Otley Road, Shipley, and lately at 51,

Lingwood Avenue, Bradford, electrical contractor, trading in co-partnership with another under the style of Ashworth & Revell, at 265, Bradford Road, Frizinghall, Bradford, and at 120, Otley Road, Shipley, electrical contractors.—Order made 25th May suspending discharge for six months until 25th November.

A. Banoff (trading as Almyn Radio Electric Co.), lately carrying on business at 111, Church Road, Hove, electrical and radio engineer.—First and final dividend of 1s 5d in the £, payable at the offices of Poppleton & Appleby, 4, Charterhouse Square, London, E.C.1.

G. Allison, 7, Alexandra Road, Penrith, Cumberland, electrical engineer and decorator.—Receiving order made 23rd June on debtor's own petition. Public examination 17th August at the County Court Offices, 39, Lowther Street, Carlisle.

R. F. C. Stephens, trading as Rapid Radio, at 48, King Street, Knutsford, and at 59, Railway Street, Altrincham, Ches., lately carrying on business under the style of Oxford Electric at 65, Oxford Road, Manchester, as a radio and electrical retailer.—Receiving order made 25th June on a creditor's petition. Public examination 2nd October at the Court House, Quay Street, Manchester.

B. G. Slater, lately carrying on business at 12, George Street, Exmouth, as an electrical engineer.—Receiving order made 3rd July on debtor's own petition. Public examination 15th October at The Castle, Exeter.

C. A. Smith, lately carrying on business at 4, Gothic Arcade, Snow Hill, Birmingham, under the style of Birmingham Electrical Co., electrical contractor.—Supplemental dividend of 1½d in the £, payable at the Official Receiver's Office, Somerset House, 37, Temple Street, Birmingham, 2.

R. J. Phipps and **W. L. Brooks,** formerly carrying on business in partnership at 4, King Street, Tamworth, under the style of Phipps Brothers, electrical contractors.—First and final dividend of 3s 4½d in the £, payable at the Official Receiver's Office, Somerset House, 37, Temple Street, Birmingham, 2.

H. Rose, 158, Soho Road, Handsworth, Birmingham, trading as Rose Electrical Service, electrical contractor and dealer.—Supplemental dividend of 2s 1½d in the £, payable at the Official Receiver's Office, Somerset House, 37, Temple Street, Birmingham, 2.

A. Moon, "Loxford," Vicarage Lane, Horley, Surrey, lately carrying on business at Eaton Cottage, Whitehall Road, Crowborough, Sussex, builder and electrical contractor.—Receiving order made 14th July on debtor's own petition. Public examination 15th October at the County Court, Scarbrook Road, Croydon.

J. A. Snowdon, residing and carrying on business as an electrical goods factor under the style of Rodelco at 147, Pittman's Field, Harlow, and also trading from Bay 31, The Stow, Harlow, Essex, and formerly from 61a, De Beauvoir Road, Islington, London, N.1.—Trustee, Mr. A. W. Hunter, Walter House, 418-422, Strand, London, W.C.2, appointed 16th July.

D. G. H. Hammerton and **A. J. Cummings,** trading as A.C.D. Electric Co., 28, West Street, Warwick, electrical engineers.—Supplemental dividend of 8d in the £, payable at the Official Receiver's Office, Somerset House, 37, Temple Street, Birmingham, 2.

F. Simons, 15, The Council House, Winchcombe Road, Sedgeberrow, Evesham, Worcs., electrical contractor.—Trustee, Mr. R. F. Bendall, 126, Colmore Row, Birmingham, 3, released 15th July.

C. A. Norwood, Thruxton, Andover, Hants., foreman electrician, formerly an electrical contractor carrying on business at 38, Thornbury Road, London, S.W.2.—Last day for receiving proofs for dividend 18th August. Trustee, Mr. W. J. W. Hill, 58-61, York Terrace, Regent's Park, London, N.W.1, Official Receiver.

D. MacIntyre, Flat 1, Mayfield, Bray Road, Maidenhead, Berks., and lately residing at 196, Courthouse Road, Maidenhead, electrical engineer.—Receiving order made 29th July on a creditor's petition.

Parliamentary Report

Cost of Nuclear Power

A fear that Britain might have dearer electricity than was necessary some years from now as a result of investing too much, too hastily, in high cost nuclear power stations, was expressed by Mr. Palmer in the House of Commons.

In reply, Sir Ian Horobin, Parliamentary Secretary to the Ministry of Power, said Britain could not afford to run any risk of completely unbalancing the structure of the industry by interfering with the present programme. After this programme was completed it would be necessary to make further decisions, but there was no need for them to be made now. Giving what he described as "the latest state of play" in the cost comparison between conventional and nuclear stations he said that, at present, a bracket of between 0·50d and 0·65d per kWh sent out would be a fair assessment for conventional stations. For nuclear stations of what were now regarded as the conventional type, the most recent figures would be between 0·65d and 0·70d. The present programme was embarked upon on the basis that somewhere in the later 1960's the fall in the price of generating by nuclear energy would cross the line of the cost of generating by coal. That situation remained true as far as anyone could estimate it.

Plutonium Production

Asked by Wing Commander Bullus what change there had been in the intention to modify three nuclear power stations to enable plutonium, suitable for military use, to be extracted should the need arise, Mr. Maudling, the Paymaster General, said that having taken into account recent developments, it had been decided to restrict the modifications to one power station, Hinkley Point.

Zeta Studies

Details of the latest ZETA developments were given by the Prime Minister in a written reply to Mr. Mason. He said that recent modifications were designed to increase by about ten times the magnetic forces on the hot gases. The engineering work had now reached the stage of final adjustments and experimental work would be resumed when they were complete. The principal subjects of study during the next months would be concerned with the increased magnetic pressure; in particular it should be possible to work with higher gas densities and at higher temperatures than hitherto. The studies were designed to yield important information on the problems of heating the gases to a high temperature and containing them.

Railway Electrification

During a debate on the British Transport Commission's revised plans for railway modernisation, Mr. Nugent, Parliamentary Secretary to the Minister of Transport, said that the success of the North Kent electrification scheme was most encouraging. The report recommended that over the next four years there should be a rapid acceleration in re-equipment. Under this plan the greater part of what was originally intended to take place by 1970 would be done by 1963.

Asked by Mr. Hobson to give a general statement on electrification, Mr. Nugent said he could see nothing to dissent from in the general plan which the Commission had outlined for electrification and dieselisation. It seemed to go in the right direction towards giving an efficient modernised service. Mr. Hobson contended that electrification was far more economical than dieselisation. He said that Britain should have gone over straight away to electric services and kept the steam locomotives in the meantime.

Contact with Overhead Lines

Mr. Holt asked how many civilians, other than workmen engaged on the erection or repair of electricity cables, suffered death or injury each year by coming in contact with electricity supply lines. Sir Ian Horobin said the number of persons involved in accidents of this kind in recent years had averaged a little under 50, of whom about one in four had suffered fatal injuries. The great majority of these accidents had been caused by mobile equipment, such as cranes or elevators, touching overhead electric lines.

Off-Peak Tariffs

A plea for low off-peak tariffs in order to increase the consumption of electricity, and thereby to increase the use of coal, was made during a debate in the Lords on the fuel and power industries. Lord Ferrier said that the off-peak rate today was, say, 0·87d. To build up the load he visualised, and build it up quickly, meant a reduction to a running rate of somewhere about ½d per kWh. He also suggested that the Minister should go into the question of purchase tax on thermal storage heating equipment which at the moment was not available to domestic electricity consumers tax free.

Replying, Lord Mills said the difficulty in the domestic field was that there were not yet sufficient off-peak appliances available. The Exchequer was aware of the point raised by Lord Ferrier.

Device to Answer Calls

Announcing that a new machine had been developed which would answer subscribers' telephones in their absence, Mr. Thompson, Assistant Postmaster General, said the machine would inform callers of the subscriber's absence, indicate when the subscriber would be available, and give an alternative number which might be called. For this machine there would be a connection charge of £2 and a quarterly rental of £10. First supplies would be available in October.

New Cable Ship

Mr. Thompson said tenders for a new cable ship to replace H.M.T.S. "Alert" had been received and were being considered.

Licensing of Nuclear Installations

The Nuclear Installations (Licensing and Insurance) Act received the Royal Assent on 9th July.

Membership of A.E.A.

Legislation will be introduced at the beginning of the next session to increase the membership of the Atomic Energy Authority, which is now limited by statute to ten, apart from the chairman.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1953

34614. Siemens Edison Swan, Ltd.—Automatic exchange systems. 9th September, 1955. (815281.)

1954

7933. Young, S. G.—Electric switches. 20th June, 1955. (815282.)

15286. Telephone Manufacturing Co., Ltd.—Frequency modulation arrangements. 17th August, 1955. (815283.)

31108. Foot, V. A.—Audio-frequency receivers for use in call systems. 27th October, 1955. (815288.)

32849. British Thomson-Houston Co., Ltd.—Rectifiers utilising semiconducting material. 9th November, 1955. (815289.)

34418. Henley's Telegraph Works Co., Ltd., W. T., Salvage, B. F., Smith, E. A., and Heinrich, R. F.—Cables for high voltage electrostatic precipitators. 25th November, 1955. (815463.)

35928. Rist, D. A. V.—Electric lighting appliances. 12th December, 1955. (815290.)

1955

2527. Cox, J. E.—Electric disconnecting switches. 24th January, 1956. (815431.)

8231. Lamplugh, W. E. P.—Electrical termination blocks. 19th March, 1956. (815293.)

12836. British Thomson-Houston Co., Ltd.—Electrical circuit arrangements employing semiconductors. 3rd May, 1956. (815361.)

12837. British Thomson-Houston Co., Ltd.—Electrical phase control generating circuit arrangements. 3rd May, 1956. (815468.)

15567. Mullard Radio Valve Co., Ltd.—Voltage stabiliser circuit arrangements. 30th May, 1956. (815294.)

17132. British Thomson-Houston Co., Ltd.—Semiconductor electrical waveform generators. 5th June, 1956. (815296.)

18332. Electroflo Meters Co., Ltd.—Electrical measuring and control systems. 25th June, 1956. (815298.)

21465. Siemens Edison Swan, Ltd.—Socket holders for electrical components. 17th July, 1956. (815299.)

21888. Napier & Son, Ltd., D.—Thermoelectric surface heaters. 20th July, 1956. (815300.)

24555. Ultra Electric, Ltd.—Electrical discriminators. 30th October, 1956. (815473.)

25665. Varian Associates.—High frequency electron discharge device. 7th September, 1955. (815526.)

26240. Radio Corporation of America.—Photoconductive materials and devices. 13th September, 1955. (815365.)

26339. British Thomson-Houston Co., Ltd.—Electrical control systems. 12th December, 1956. (815366.)

26477. General Electric Co.—Cathode-ray discharge devices. 15th September, 1955. (815476.)

28217. Garnerot & Co. (Consolidated Agencies), Ltd.—Means for detachably securing leads to electrical connectors. 4th October, 1955. (815478.)

28405. General Electric Co., Ltd.—Protective arrangements for electrical systems, such, for example, as tachometer generator systems. 5th October, 1956. (815479.)

28531. General Electric Co., Ltd.—Control systems for a.c. motors. 8th October, 1956. (815480.)

28710. Hulbert, C. Lacy-.—Electric heating elements. 3rd January, 1957. (815368.)

29839. Rank Cintel, Ltd.—Electronic apparatus for timing events. 19th October, 1956. (815481.)

34308. Mond Nickel Co., Ltd.—Electric heating devices. 30th November, 1955. (815312.)

35044. Kalynycz, I., and Cox, W. A.—Control systems for electric motors. 4th March, 1957. (815313.)

36074. General Electric Co., Ltd., Barkwith, A. D. B., and Thomas, E. R.—Apparatus for photographically recording the variations with time in the magnitude of a given variable. 15th March, 1957. (815233.)

1956

864. Sanders (Electronics), Ltd., W. H.—Mechanism for the control of strip materials. 9th January, 1957. (815648.)

8119. Telefunken G.m.b.H.—Speed indicators for rotatable members. 15th March, 1956. (815322.)

9287. Allmänna Svenska Elektriska A.B.—High voltage power transmission systems. 26th March, 1956. (815489.)

9625. Ericsson Telephones, Ltd.—Electroscope charging devices. 28th March, 1956. (815490.)

9666. General Electric Co.—Electrical analogue computing apparatus. 28th March, 1956. (815326.)

10456. General Electric Co., Ltd.—Field excitation arrangements for electric alternators. 4th April, 1957. (815327.)

10677. Cole, Ltd., E. K., and Pichal, H. T.—Mixer circuits in television receivers. 9th April, 1957. (815330.)

12990. Marconi's Wireless Telegraph Co., Ltd.—Processes for the manufacture of alloy type semiconductor rectifiers and transistors. 24th January, 1957. (815335.)

20352. Backer Electric Co., Ltd.—Electric heaters. 2nd July, 1957. (815242.)

21301. Grubb, K. T., and Grubb, B. (trading as Struers Chemiske Laboratorium, H.).—Apparatus for producing a constant voltage from a non-constant alternating voltage source. 10th July, 1956. (815497.)

21662. United Kingdom Atomic Energy Authority.—Voltage measuring circuits. 5th July, 1957. (815539.)

21711. International Computers & Tabulators, Ltd.—Magnetic core data storage apparatus. 25th June, 1957. (815540.)

22760. Power Connectors, Ltd.—Joining electric conductors. 25th November, 1957. (815541.)

23307. Standard Telephones & Cables, Ltd.—Railway signalling equipment. 27th July, 1956. (815542.)

24710. Hazeltine Corporation.—Automatic gain control system for transistor circuits. 13th August, 1956. (815389.)

25735. Allmanna Svenska Elektriska A.B.—Control systems for electric motors operating mooring winches and the like. 23rd August, 1956. (815544.)

25957. Standard Telephones & Cables, Ltd.—Electrical switches. 23rd August, 1957. (815252.)

26272. Beswick, D. G. E., Beswick, K. E., and Melbourn, W. F.—Electric fuses. 5th July, 1957. (815390.)

26283. Western Electric Co., Inc.—Code translators. 28th August, 1956. (815545.)

27653. Self-Changing Gears, Ltd.—Generator arrangements for the electrical control of change-speed gearing employing a variable voltage generator. 2nd Septemb :r, 1957. (815255.)

27778. U.D. Engineering Co., Ltd.—Cathode-ray tube apparatus for the inspection of articles. 29th August, 1957. (815392.)

28141. Western Electric Co., Inc.—Electric signal circuits using transistors. 14th September, 1956. (815393.)

28545. Varian Associates.—Electron tube apparatus. 18th September, 1956. (815527.)

31925. General Electric Co.—Cathode-ray tubes. 19th October, 1956. (815265.)

34138. Pirelli S.P.A.—Paper screening tape for high-tension electric cables. 8th November, 1956. (815394.)

35312. General Electric Co., Ltd.—Manufacture of hermetically sealed vessels containing gas under pressure. 19th November, 1957. (815395.)

36495. Muirhead & Co., Ltd.—Facsimile scanning mechanism. 29th November, 1957. (815553.)

37640. Amp, Inc.—Hand tool for crimping electrical connectors. 10th December, 1956. (815447.) 39294. Electrical connections. 27th December, 1956. (815554.)

1957

3965. Carr Fastener Co., Ltd.—Electrical connectors. 28th November, 1957. (815019.)

6277. Siemens-Schuckertwerke A.G.—Steam generators. 25th February, 1957. (815406.)

6911/2. Western Electric Co., Inc.—Pulse code modulation sampling and encoding systems. 1st March, 1957. (815535/6.)

7608. Thermel, Inc.—Electric heating units and their manufacture. 7th March, 1957. (815559.)

8583. Proctor Electric Co.—Control apparatus for heating units. 15th March, 1957. (815408.)

9894. Amp, Inc.—Electrical connector. 26th March, 1957. (815581.)

12911. Marconi's Wireless Telegraph Co., Ltd.—Saw tooth wave generators. 3rd February, 1958. (815411.)

14687. A.G. für Unternehmungen der Eisen- und Stahlindustrie.—Electric arc melting furnace. 8th May, 1957. (815412.)

19170. Western Electric Co., Inc.—Tuned cavity resonators. 18th June, 1957. (815689.)

21571. Welwyn Electrical Laboratories, Ltd.—Electrical resistors. 8th July, 1957. (815359.)

25654. Sorensen-Ardag.—Voltage regulator. 14th August, 1957. (815418.)

25674. Batstra, J. B.—Electrode holder for welding. 14th August, 1957. (815419.)

27596. Philips Electrical Industries, Ltd.—Solid-state image intensifiers. 2nd September, 1957. (815422.)

29705. Cleveland Electric Motor Co.—Brake for a dynamo-electric machine. 20th September, 1957. (815426.)

32478. Compagnie Française Thomson-Houston.—Construction of electrical semiconductor components. 17th October, 1957. (815430.)

32525. Minneapolis-Honeywell Regulator Co.—Capacitors. 17th October, 1957. (815449.)

32585. Standard Telephones & Cables, Ltd.—Electromechanical resonant vibrator. 18th October, 1957. (815450.)

35649. Telefunken G.m.b.H.—Diversity radio receiving systems. 15th November, 1957. (815457.)

38770. Sperry Rand Corporation.—Travelling-wave tubes. 13th December, 1957. (815459.)

39882. General Electric Co.—Silicon steel with improved magnetic anisotropy and method of making same. 23rd December, 1957. (815569.)

1958

16395/6. Varian Associates.—Electron tube apparatus. 18th September, 1956. (Divided out of 815527.) (815528/9.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Ampthill.—U.D.C. 24th August. Group "B" street lighting equipment. Surveyor, Council Offices, 10, Bedford Street.

Argentina.—Empresa de Agua y Energia Eléctrica, 1554, Calle Lavalle, Buenos Aires. The *Fortnightly Review* of the Bank of London and South America reports the following extensions of closing dates for public tenders:—13th October. Electro-mechanical installation at Las Pirgintas hydro-electric power station (Tender No. 120/59). 15th October. Civil constructional work and electro-mechanical installations for a thermal power station at Sorrento and the Rosario Norte transformer substation (Tender No. 190/58.)

Australia.—Postmaster General's Department, Melbourne. 27th August. Uniselector maintenance parts. (E.S.B. 17523/59. Ten/40588.)* 22nd September. Telephone timing clocks and master clocks. (E.S.B. 17157/59. Ten/40762.)*

State Electricity Commission of Western Australia, Perth. 17th September. Star delta and neutral earthing transformers. (E.S.B. 16184/59. Ten/40305.)*

State Electricity Commission of Victoria, Melbourne. 26th August. Four 220 kV transformers. (E.S.B. 17963/59. Ten/40716.)*

Barnes.—Borough Council. 21st September. Group "A" street lighting equipment. W. R. Shepherd, borough engineer, Municipal Offices, Sheen Lane, S.W.14.

Burma.—Burma Applied Research Institute, Rangoon. 15th September. Telephone apparatus. (E.S.B. 17457/59/I.C.A. Ten/40641.)*

Burnham-on-Sea.—U.D.C. 22nd August. Street lighting equipment. G. H. Mayhew, engineer, Manor House.

Canada.—Winnipeg Hydro-Electric System, 2nd September. Relaying equipment for substations. (E.S.B. 18018/59. Ten/40801.)* 16th September. 69 kV cable and potheads. (E.S.B. 17871/59. Ten/40692.)*

Dartford.—Corporation. 1st September. Underground cabling for street lighting. (See this issue.)

Ealing.—Corporation. 31st August. Group "A" street lighting equipment. (See this issue.)

Egypt.—Egyptian Railways, Cairo. 1st September. Electrification of signals from Cairo to Qaluib. (E.S.B. 15539/59. Ten/40035.)*

Formosa.—Central Trust of China, Taipei. 24th August. Two 100 kW petrol electric generator sets and five submersible pumps. (E.S.B. 18282/59/I.C.A. Ten/40865.)* 29th August. 300 distribution transformers ranging from 10 to 20 kVA. (E.S.B. 18277/59/I.C.A. Ten/40889.)*

Friern Barnet.—U.D.C. 28th August. Renewal and additions to electrical installations in 100 houses. (See this issue.)

Greece.—Ministry of Communications and Public Works, Civil Aviation Service, Athens. 24th August. Wave winding machine and transformer and coil winding machine. (E.S.B. 18187/59. Ten/40882.)* 25th August. Earphones, loudspeakers and microphones. (E.S.B. 18246/59. Ten/40850.)* 26th August. Resistors, capacitors and potentiometers. (E.S.B. 18186/59. Ten/40857.)*

Hendon.—Borough Council. 21st August. Electrical fittings (Schedule No. 6), for the period ending 30th September, 1960. Borough engineer, Town Hall.

India.—Kanpur Electricity Supply Administration. 1st September. Twenty-nine distribution transformers, ranging from 50 kVA to 1,000 kVA. (E.S.B. 18153/59. Ten/40800.)*

Director General of Supplies and Disposals, New Delhi. 24th September. Telecommunication cables and accessories. (E.S.B. 16815/59. Ten/40418.)*

Calcutta Corporation. 23rd October. Electrically driven pumping sets. (E.S.B. 17630/59. Ten/40616.)*

Iraq.—Directorate General of Municipalities, Baghdad. 22nd August. Transformers. (E.S.B. 17832/3/59. Ten/40670 and 40675.)*

Iraqi Ports Administration, Margil. 20th September. Automatic v.h.f. radio telephone network. (E.S.B. 17601/59. Ten/40621.)*

Malta.—Maltese Government. 1st October. Water pumping plant. (See this issue.)

New Zealand.—G.P.O., Wellington. 21st August. Potentiometers. (E.S.B. 17491/59. Ten/40567.)* 9th September. Relays. (E.S.B. 17938/59. Ten/40713.)*

New Zealand Electricity Department, Wellington. 27th October. Two 36 MW generators. (E.S.B. 16742/59. Ten/40426.)* Two 50,000 b.h.p. turbines. (E.S.B. 15743/59. Ten/40427.)*

Pakistan.—Government Department of Supply and Development, Chittagong. 31st August. Three 50 kW diesel engine driven generating sets. (E.S.B. 17944/59. Ten/40722.)*

West Pakistan Water and Power Development Authority, Lahore. 10th September. Grid station, e.h.v. switchgear, busbars and structures. (E.S.B. 17195/59/I.C.A. Ten/40661.)*

Director General, Posts and Telegraphs, Karachi. 25th August. Armoured underground cable. (E.S.B. 17932/59/I.C.A. Ten/40746.)*

Philippines.—National Power Corporation. 8th September. One 64,000 kVA power transformer. (E.S.B. 18203/59. Ten/40837.)*

Portuguese East Africa.—Civil Aeronautical Department, Lourenço Marques. 25th August. Luminous signalling installations for airport. (E.S.B. 18118/59. Ten/40753.)*

Rhodesia and Nyasaland.—Federal Tender Board, Causeway. 21st August. Thirty-three diesel engine generator plants. (E.S.B. 18614/59. Ten/40960.)*

Saudi Arabia.—National Saudi Electric Co., Riyadh. 31st August. H.v. and l.v. cable system in Riyadh City. (E.S.B. 16410/59. Ten/40263.)*

Scunthorpe.—Corporation. 28th August. Trunk road lighting equipment. (See this issue.)

South Africa.—Cape Town Corporation. 2nd September. Switchgear and transformers for Athlone "A" power station extension. (E.S.B. 17489/59. Ten/40565.)*

Stores Department, South African Railways, Johannesburg. 21st August. Main rectifier transformers. (E.S.B. 17810/59. Ten/40805.)* Fluorescent lighting fittings. (E.S.B. 17808/59. Ten/40810.)* Telegraph line material. (E.S.B. 18074/59. Ten/40806.)* Electric cable. (E.S.B. 17807/59. Ten/40811.)*

Union Tender Board, Pretoria. 27th August. Forty motor driven sirens. (E.S.B. 18219/59. Ten/40849.)* Switchboard spares. (E.S.B. 18216/59. Ten/40851.)*

Sudan.—Posts and Telegraphs Department, Khartoum. 24th August. Carrier quad cable. (E.S.B. 16809/59. Ten/40414.)*

Tamworth.—Borough Council. 31st August. Street lighting equipment. H. F. Bruce Smith, borough engineer, Municipal Offices.

Winchester.—Corporation. 11th September. Street lighting equipment. (See this issue.)

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

London.—L.C.C. Renewal and improvement of electrical installations in 421 dwellings at Totterdown Fields estate, Wandsworth (£16,762).—Electric Contracts (London), Ltd. Electrical installations in 1,053 dwellings and public lighting at Old Oak estate, Hammersmith (£34,213).—J. & W. Mayer, Ltd. Installation of electric water heaters in 261 dwellings at Watling Estate, Hendon (£14,014).—F. J. Baynes & Co., Ltd. Supply and fixing of electric water heaters in 110 dwellings at Downham Estate, Lewisham (£5,545).—J. B. Jackson & Partners, Ltd. Three electric passenger lifts at Central School of Arts and Crafts and Holborn College of Law, Languages and Commerce, Holborn (£28,193).—Bennie Lifts, Ltd.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Accrington.—Development of industrial estate at Huncoat; J. W. Buick, borough engineer.

Ashington (Northumberland).—Five-storey flats, Sixth Avenue; U.D.C. surveyor.

Ashton-in-Makerfield.—Houses (90), Low Bank Road estate; F. Dean, clerk to U.D.C., Town Hall, Ashton-in-Makerfield, Lancs.

Aycliffe (Co. Durham).—Factory additions for R. W. Toothill, Ltd.; D. & J. Ranken, Ltd., contractors, Stockton Road, Sunderland.

Barnes.—Three blocks of dwellings (114 flats), Westfields development; borough engineer, Municipal Offices, Sheen Lane, East Sheen, S.W.14.

Basildon.—Dwellings (374), Ghyllgrove area; Brett, Boyd & Bosanquet, architects, 189, Regent Street, London, W.1.

Bingham.—Houses at Bingham (52) and Keyworth (51); R.D.C. surveyor, Bingham, Notts.

Plans for estate of 62 dwellings at Normanton-on-the-Wolds; G. Wimpey & Co., Ltd., 8, Beechdale Road, Wollaton, Notts.

Birmingham.—Extensions to pathological laboratory, Little Bromwich General Hospital (£47,350); Birmingham Regional Hospital Board, 10, Augustus Road, Edgbaston, 15.

Blaydon (Co. Durham).—Offices for Shell Mex & B.P., Ltd.; W. & T. R. Milburn, architects, 18, Fawcett Street, Sunderland.

Cheadle (Staffs).—R.C. secondary school (£140,844); A. C. H. Stillman, Staffs. county architect, Martin Street, Stafford.

Cheshire.—Extensions to county training colleges at Crewe (£355,000) and Alsager (£189,000); J. G. Kellett, director of education, City Road, Chester.

Chester-le-Street.—Houses (102) on the Bournlea housing estate; William Leech, Ltd., builders, St. James Street, Newcastle-on-Tyne.

Connah's Quay.—Construction of new swimming bath and assembly hall; J. G. L. Poulson, architect, 29, Ropergate, Pontefract.

Darlaston.—Grammar and technical school (£241,032); director of education, Lichfield Road, Stafford.

Darlington. — Crematorium at West Cemetery (£36,000); W. S. Hutton, Ltd., contractors, 43, Coniscliffe Road.

Dewsbury.—Thornhill Secondary Modern School (£177,144); borough engineer, Municipal Buildings, Halifax Road.

Edinburgh.—Replacement of Parsons Green School, Meadowfield (£144,180) and construction of two blocks of 11-storey flats, Muirhouse Parkway; A. Steele, city architect, City Chambers, High Street.

Gateshead.—Proposed boys' grammar school for the E.C. (£200,000); G. F. Winters, borough engineer.

Glasgow.—Extensions to Royal College of Science and Technology, George Street; Wylie, Shanks & Underwood, architects for scheme, Claimont Gardens, Glasgow.

Great Yarmouth.—Central library, art galleries and lecture hall, Tolhouse Street; Farra Conway, town clerk, Town Hall.

Hainault.—Factory and offices, Fowler Road; Glendale Cabinet Co., Ltd., 555, Commercial Road, London, E.1.

Hartlepool.—Office additions for Richardsons, Westgarth & Co., Ltd.; Holland & Hannen and Cubitts, Ltd., contractors, Howdon-on-Tyne.

Hemel Hempstead.—Secondary technical school, Wardsend, Gade Bridge (£305,909); Herts. county architect, County Hall, Hertford.

Jarrow.—Factory for North-Eastern Trading Estates, Ltd.; Newrick & Blackbell, architects, 58, John Street, Sunderland.

Kendal.—Extensions to County Hall (£101,000), for Westmorland C.C.; county architect, County Hall, Kendal.

Liverpool.—Junior school at Broad Square School (£80,000) and gymnasium and laboratories at Calder High School (£34,000); city engineer, Municipal Buildings, Dale Street, Liverpool, 2.

London.—Eleven-storey block of shops and offices on site of Chiswick Empire; E. J. Cook & Co. (Engineers), Ltd., 54, South Side, S.W.4.

Laboratory block (£335,000) at Campden Hill, Kensington, for Queen Elizabeth College, University of London; Adams, Holden & Pearson, architects, 38, Gordon Square, London, W.C.1.

Multi-storey offices, New Street, Bishopsgate; Chaucer Estates, Ltd., 51, Piccadilly, W.1.

Works extensions, Sydenham; Mayborn Products, Ltd., Dylon Works, Berrymans Lane, S.E.26.

Flats (160), Hide Place, S.W.; Stillman & Eastwick-Field, architects, 30, John Street, Bedford Row, W.C.1.

Longbenton (Northumberland).—Hostel for transport workers (£75,000), Whitley Road, for J. W. Capstaff, Ltd., haulage contractors, Coach Lane, Newcastle-on-Tyne; Waring & Netts, architects, 36, Jesmond Road, Newcastle-on-Tyne.

Manchester.—Factory and offices, Longley Road, Northenden; Benrath Machine Tools, Ltd., Leestone Road.

Margate.—Shops and offices, High Street; Pearl Assurance Co., Ltd., High Holborn, London, W.C.1.

Market Rasen.—Extensions at Dr. Ashton School (£100,000); Lindsey county architect, Lincoln.

Newcastle-on-Tyne.—Proposed secondary modern schools for boys and girls at Westbourne Avenue for the E.C. (£280,000); G. Kenyon, city architect, 18, Cloth Market, Newcastle.

North Riding.—Primary school at Ormesby (£43,000); D. C. Hall, architect, Duke Street St. James's, London, S.W.1.

Ramsgate.—Blocks of six- and nine-storey flats, Newcastle Hill clearance area; borough engineer, Municipal Buildings.

Rochdale.—County secondary school at Kingsway; borough surveyor, Town Hall.

Romford.—Factory, Victoria Road; C. & L. Roberts, Ltd., 79, Washington Avenue, London, E.12.

St. Helens.—R.C. secondary school, Red Rocks (£225,000); M. Ward, borough engineer, Town Hall.

Scarborough.—Houses (182); M. J. Liddell & Son, builders, Great North Road, Newcastle-on-Tyne.

Scunthorpe.—New municipal offices and Council suite; C. B. Pearson & Son, architects to Council, 18, Dalton Square, Lancaster.

Shrewsbury.—Nurses' home and training school, Shelton Hospital (£115,800); Birmingham Regional Hospital Board, 10, Augustus Road, Edgbaston, Birmingham, 15.

South Shields.—X-ray department at Ingham Infirmary; P. H. Knighton, chief architect, Newcastle Regional Hospital Board, Benfield Road, Newcastle-on-Tyne.

Southampton.—Central health clinic, flats (196), in five-storey blocks, Northam re-development area, and 12-storey block of 72 flats, Lansdowne Hill re-development scheme; borough engineer, Civic Centre.

Stirlingshire.—Reconstruction of junior secondary school, Camelon (£151,892); county architect, County Offices, Viewforth, Stirling.

Stockport.—Boys' secondary technical school, Offerton, and county secondary schools at South West Stockport and Brinnington; J. Rank, borough architect.

Tynemouth.—Factory additions for British Die Casting Co., Ltd.; G. H. Gray & Partner, architects, 8, Portland Terrace, Newcastle-on-Tyne.

Factory additions for Clay & Son; W. Stockdale, architect, 73, Howard Street, North Shields.

Houses (43), Briarwood Avenue; borough engineer, 16, Northumberland Square, North Shields.

Watford.—Factory, printing premises and offices, Holywell Industrial Estate; H. L. Castle, Ltd., Victoria Printing Works, Water Lane, Watford.

Wells.—Reconstruction of Assize Courts; R. O. Harris, Somerset county architect, Park Street, Taunton.

Wolverhampton.—Dwellings (98) in five 4-storey blocks and one two-storey block of flats for old people, with laundries, etc., Wright Street re-development area; borough engineer, Town Hall.

C.E.G.B. CONTRACTS

The Central Electricity Generating Board has placed contracts during the past two months for power stations, transmission lines and transforming stations amounting in the aggregate to approximately £28,197,000. They include the following:—

Bankside "B": One 120 MW turbo-generator.—English Electric Co. Condensing and feed heating plant for No. 3 set.—Worthington-Simpson.

Northfleet: H.p. pipework and valves for Nos. 5 and 6 sets.—Aiton & Co. Main connections between generators and transformers and associated equipment for Nos. 4, 5 and 6 sets.—British Insulated Callender's Cables. Mobile coal, ash and dust handling equipment.—John Blackwood, Hodge & Co.

Plymouth "B": Main and auxiliary power cables, control cables, accessories and station earthing.—Siemens Edison Swan.

West Thurrock: 3·3 kV auxiliary switchgear, control desks and accessories.—English Electric Co. Superstructures for administrative block and workshop, turbine house, annexes and auxiliary buildings.—Richard Costain.

Uskmouth "B": Building superstructure and other works.—John Morgan (Builders). Extensions to railway sidings.—Thos. W. Ward.

Willington "B": Main superstructure.—M. J. Gleeson (Contracts). Structural steelwork.—Peirson & Co.

Rugeley: 144 kVA generator transformer No. 3.—English Electric Co. Structural steelwork.—Horseley Bridge & Thomas Piggott. Five 120 MW reheat boilers.—Babcock & Wilcox.

Blyth "B": Station unit transformer.—Yorkshire Electric Transformer Co. 200-ton overhead travelling crane.—Cowans, Sheldon & Co.

Thorpe Marsh: Structural steelwork for turbine house and boiler house.—Redpath Brown & Co. One 550 MW reheat boiler.—International Combustion. Piling (stage 1).—Holloway Bros. (London).

Padiham "B": Main building superstructure and ancillary buildings.—M. J. Gleeson. 3·3 kV auxiliary switchgear.—A. Reyrolle & Co.

Skelton Grange "B": 13·8 kV cables and accessories.—N. G. Bailey & Co.

Staythorpe "B": Auxiliary, control and instrument cables and earthing.—W. T. Henley's Telegraph Works Co.

Aberthaw: Heating, lighting and plug point installation.—F. H. Wheeler & Co.

Golborne substation: Two 60 MVA, 132/33 kV transformers.—Crompton Parkinson.

Sundon substation: One 60 MVA, 132/33 kV transformer.—Fuller Electric.

Letchworth substation: Two 45 MVA, 132/33 kV transformers.—Fuller Electric.

Hereford substation: One 45 MVA, 132/66 kV transformer.—General Electric Co.

Black Lake substation: Two 30 MVA, 132/11 kV transformers. — Crompton Parkinson.

Hubberston substation: Two 30 MVA, 132/11 kV transformers.—Brush Electrical Engineering Co.

Warwick substation: Two 30 MVA, 132/11 kV transformers.—Brush Electrical Engineering Co.

Lydd substation: Transformers 85/102/55 MVA, 275/90/33 kV.—Fuller Electric.

Hart Moor substation: 275 kV switchgear.—Ferguson Pailin.

Windscale-Egremont and Windscale A.G.R. substation: 132 kV overhead lines.—Pirelli-General Cable Works.

Willenhall substation: 132 kV cable.—W. T. Henley's Telegraph Works Co.

Iver substation: Site works.—A. Jackaman & Son.

Lackenby substation: Site works.—A. Monk & Co.

Scunthorpe North substation: Two 60 MVA, 132/33 kV transformers.—Metropolitan-Vickers Electrical Co.

Yarnton substation: One 45 MVA, 132/33 kV transformer.—Hackbridge & Hewittic Electric Co.

Taunton substation: One 45 MVA, 132/33 kV transformer.—General Electric Co.

Norton substation: 275 kV, 7,500 MVA switchgear.—British Thomson-Houston Co.

West Boldon substation: 275 kV, 7,500 MVA switchgear.—A. Reyrolle & Co.

Hayle substation: 132 kV switchgear.—General Electric Co.

Fraddon substation: 132 kV switchgear.—General Electric Co.

Newton-Oswestry: 132 kV single-circuit, wood pole, overhead line.—British Insulated Callender's Construction Co.

Tilbury 275 kV substation: Site works.—J. L. Eve Construction Co.